ACE Supplemental Responses
Welsh Unit 1
December 15, 2020

Figure 6: Welsh Unit 1 Binned Compliance Standards

Welsh Unit 1			2016 - 2018					2017 - 2019				
					CO2 Emission Rate lb/MWH Gross)					CO2 Emission Rate lb/MWH Gross)		
Bin	% Gross MW	Gross MW	# Hours	% Hours	Average	3 Std Dev	Average + 3 Std Dev	# Hours	% Hours	Average	3 Std Dev	Average + 3 Std Dev
1	27-40	150-226	3208	15%	2279	301	2580	4190	18%	2319	257	2576
2	40 1-55	227-310	2848	14%	2183	264	2447	3455	15%	2216	267	2483
3	55 1-70	311-395	3014	14%	2127	198	2325	3270	14%	2151	213	2364
4	70 1-85	396-479	3390	16%	2110	193	2303	3641	16%	2139	219	2357
5	> 85	480-564	8632	41%	2142	213	2355	8325	36%	2168	236	2404
All	≥ 27	150-564	21092		2148	284	2432	22881		2180	304	2484

For each future compliance period, MWh weighted average values should be calculated for each bin and averaged together. The formula used to calculate the 24-month average compliance limit is set forth below:

$$\textit{Compliance limit (lbs-CO2/MWh}_g) = \frac{[(h_1*r_1)+(h_2*r_2)+(h_3*r_3)+(h_4*r_4)+(h_5*r_5)]}{\textit{total MWh in all load bins}}$$

Where h_n = equals total MWh in load bin_n during the compliance period

And r_n = equals the historic average rate for bin_n + 3 standard deviations

The averaging period for the recommended standard should consist of at least 24 consecutive operating months. If the rate for the compliance period calculated by dividing the total pounds of CO_2 emitted (as measured at all loads above the minimum stable operating load by the total megawatt hours of generation in all load bins above the minimum stable operating load is less than the compliance limit, the unit would be in compliance with the standard.

There are a number of other sources of uncertainty and variability that may affect future compliance with a CO_2 emission standard, both known and unknown. A detailed discussion of such factors, and a much more complicated proposed standard was recently included in a partial state plan developed by the West Virginia Department of Environmental Protection (WVDEP) for the Longview Power Plant available at https://dep.wv.gov/daq/publicnoticeandcomment/Documents/Proposed%20WV%20ACE%20State%20Partial%20Plan.pdf Although WVDEP rejected an adjustment based on three times the standard deviation in its plan, its ultimate standard used two times the standard deviation plus additional adjustments based on fuel quality and uncontrollable operational and mechanical issues at the unit. SWEPCO considered these sources of additional variability, but chose to include TCEQ's default adjustment in its recommended standard due to its ease of implementation.

Step 2

• *Detailed justification for recommended final standards, which may consider remaining useful life of the facility and other factors such as unreasonable cost of control, physical impossibility of control, or other factors that make application of the measure unreasonable (40 CFR §60.24a(e)).*

• *If you are relying on remaining useful life as part of the justification for the final recommended standard, provide the following information.*

o Number of years the unit is expected to continue operating beyond 2019 given current economic conditions

o Basis of estimated remaining useful life

o Feasibility of making a federally enforceable commitment to a future retirement date

SWEPCO has used the most recent operating data for Welsh Unit 1 to provide emission data and heat rates that reflect the degree of emission limitation achievable using current equipment and operating and maintenance practices. This unit will be retired no later than October 17, 2028, less than four and a half years after the commencement of the first ACE compliance period. It would be unreasonable to require this unit to make capital investments or spend significant additional resources for operating and maintenance expenses beyond those required to maintain efficient operation of the unit. The recommended standard must be flexible enough to accommodate end of life operations for this unit, and therefore setting the standard based on historic averages within each of the load bins described above plus three standard deviations is appropriate.

Additional Information

• *Description of any future expected overhauls or equipment replacements not already accounted for in measures listed above that would be needed to maintain unit heat rate and CO2 emission rate beyond initial compliance, e.g., shortened equipment life resulting in more frequent replacement and additional costs*

• *Description of any future potential installations of environmental control equipment that would increase the on-site parasitic load, including resulting estimated potential increase in on-site electricity use in MWh per year Facility*

Not applicable.

Future Operational Information—40 CFR §60.5740a(4)(i)(A)–(F)

Responses regarding future operational characteristics can be based on publicly available information rather than potentially confidential company-specific information, if you provide the source of the publicly available information (e.g., DOE data, information provided by utilities to the applicable regional transmission organization and/or independent system operator).

• *Summary of each designated facility's anticipated future operational characteristics and basis of estimation*

o *Annual gross and net generation, MWh*

o *Annual CO2 emissions, in tons*

o *Fuel use, prices, and carbon content*

o *Fixed and variable O & M costs*

o *Heat rates*

o *Electric generating capacity and capacity factors*

• *Future operational characteristics should be provided for 2025, 2030, and 2035. For units with an expected retirement date earlier than 2035, data only needs to be provided for those five-year intervals prior to the expected retirement date.*

SWEPCO has provided the requested projected information as confidential business information in a separately attached Exhibit A for calendar year 2025 only, since Welsh Unit 1 will cease combusting coal in 2028.

Affordable Clean Energy Rule State Plan
Company Information Collection Request

Southwestern Electric Power Company

Welsh Unit 3

Submitted October 30, 2020

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Welsh Unit 3

Southwestern Electric Power Company (SWEPCO) submits the following information in response to the information collection request (ICR) sent by the Deputy Director of the Office of Air Quality at the Texas Commission on Environmental Quality (TCEQ) on February 25, 2020. SWEPCO appreciates the opportunities provided by TCEQ to engage with the Office of Air Quality during the preparation of these responses, and would be happy to meet with TCEQ representatives to discuss any questions regarding them or any further information needs the agency may have.

Ongoing evaluations under other recently finalized federal environmental regulations have not yet been completed, and will impact the baseline evaluation and projected future emissions and operating conditions. TCEQ has extended the time to complete these sections of the ICR response until December 15, 2020.

Basic Information:

Please provide the baseline carbon dioxide (CO2) emissions rate and baseline heat rate for each designated facility. Provide the baseline information for different load segments if you are recommending separate standards based on different operating loads. Baseline calculations should include data from all operations during the selected baseline period.

Use default equation or supply data, calculations, and justification for a different approach.

Provide a detailed justification for selected period.

Provide Design firing rate capacity in MMBtu/hr for full load.

Provide Nameplate, summer, and winter generation capacity in MW, if changed since most recent DOE Energy Information Administration Form 860 submittal.

Welsh Unit 3 design firing rate capacity is 5159 MMBtu/hr based on Babcock & Wilcox ("B&W") design specifications for boiler maximum continuous rating (MCR) point.

The most recent DOE Energy Information Administration Form 860 lists the capacity of Welsh Unit 1 as 528 MW as the maximum summer and winter rating and 150 MW as the minimum summer and winter rating.

Ongoing evaluations under other recently finalized federal environmental regulations have not yet been completed, and will impact the baseline evaluation and projected future emissions and operating conditions. TCEQ has extended the time to complete these sections of the ICR response until December 15, 2020.

Heat Rate Improvement Measures

The company must assess the feasibility of each of the EPA's seven heat rate improvement measures for each designated facility. Companies should review the EPA's ACE rule preamble and referenced technical support documents for additional details on each measure. If separate standards are recommended based on different operating loads, assess the feasibility of the measures at each segment.

Cost Information requested can be based on the cost information included in the EPA's ACE rule preamble and/or referenced technical support documents or other cost data may be provided. Reference the basis for any other cost data provided (e.g., vendor estimates, the EPRI Cost Manual Estimator, or the EPA Pollution Control Cost Control Cost manual).

1. **Neural Networks and Intelligent Sootblowers**

Provide the following for each heat rate improvement measure:

- *If the measure is already implemented, provide the following:*
  - *Describe your current equipment and/or system as it relates to the measure.*
  - *Provide the date the measure was first installed/operated.*
  - *If the measure was installed after the baseline period (i.e., years used to determine the baseline rates), quantify the impact on your heat rate, in percent and Btu/KWh.*

Welsh Unit 3 utilizes a Distributed Control System (DCS) and Process Information (PI) monitoring systems to provide the unit operators with a full view of the critical operating conditions on the unit. The DCS and PI together are the functional equivalent of a Neural Network. Welsh Unit 3 also utilizes a Diamond Power Intelligent Soot blowing system.

In the ACE Rule, a neural network is defined as a computer model that can be used to optimize combustion conditions, steam temperatures, and air pollution controls at a steam generating unit. A number of computerized systems have been developed and marketed by vendors, each of which contains a specific suite of sensors and monitors, and each of which is designed to work with specific modeling software based on the fundamental engineering principles that apply to the combustion or steam conditions at that particular unit, and the specific air pollution controls that have been installed at the unit.

The PI and DCS systems at Welsh Unit 3 rely on the same types of monitors and sensors included in most Neural Network packages. Over a hundred different parameters from various systems and equipment are measured across the unit. These include primary and secondary air flows and temperatures, air and gas pressures and flows, pressure differentials for certain critical equipment, auxiliary loads, feedwater flow, fan speeds and pitch, and other measurements. Subsystems that are monitored and evaluated include the air heaters, pulverizers, burners, fans, dampers, feedwater heaters, reheaters, economizers, superheaters, boiler feed pumps, turbines, generators, air pollution control equipment, condenser systems, and electrical systems.

A neural network installation collects and evaluates the information from sensors installed on a single unit or small group of units at a single location, and recommends adjustments, triggers alarms or other notifications to the unit operators, or automates certain functions through the computer tracking and predictive software. Operators can respond and make adjustments as appropriate, investigate unusual conditions, or enter work orders into the plant maintenance system. The PU and DCS systems at Welsh Unit 3 provide similar information to unit operators, adjust certain controls automatically, and can generate alarms and prompt specific actions to be performed manually.

In addition, SWEPCO is one of six operating subsidiaries in the American Electric Power (AEP) system that own and operate fossil fueled-units. The AEP system includes over 30,000 MW of generating capacity, approximately 5,300 MW of which is renewable energy capacity. AEP companies operate approximately 12,000 MW of coal-fired capacity. Among the coal-fired units on the AEP system, there are several "series" of like-sized units of similar design.

The similarities in size and design of the various AEP series of units have made information sharing and performance tracking a hallmark of AEP's culture. In the 1970s, AEP developed a training center for unit operators, and equipped it with a generator simulator that mimicked the real experience of manning the unit controls at one of the system's plants. This in turn led to the creation of a centralized Monitoring & Diagnostics Center (MDC) in 2014, co-located with the training center in St. Albans, West Virginia.

At the MDC, thousands of instrument readings from the majority of the AEP fossil fleet are gathered and monitored. The information comes directly from the PI and DCS systems in real time. Information about sensor conditions and status and data trending and evaluation through the use of pattern recognition software allow the center to notify plant personnel of the need to check, replace, or repair individual sensors, or take other actions to respond to abnormal operating conditions. The MDC has built numerous models around critical processes within the AEP units, and is able to communicate and collaborate with plant and system operators to investigate and remedy conditions before equipment damage occurs. In a sense, the MDC serves as a virtual fleet-wide neural network for AEP's fossil units.

The MDC has the capability to monitor and trend individual data points remotely in real time, spot early trends, and proactively recommend actions to improve performance or eliminate a curtailment before costly damage occurs. Based on the information available through these systems, operators are able to distinguish between controllable and uncontrollable factors impacting heat rate on the unit, and take prescribed actions to reduce the impacts associated with controllable factors as much as physically and economically possible. Intensive operator training, including the use of a centralized control system generator simulator during that training, provides our personnel with the knowledge necessary to initiate appropriate changes in operating parameters, and monitor the effects of automated responses in certain supplemental control systems, to assure that stability is achieved and maintained during all operating conditions.

The capabilities of the MDC are essentially equivalent to the capabilities of a neural network on an individual unit, but with several distinct advantages not present with third party systems. First, the centralized function at MDC reduces the personnel and expense that would be required to support neural networks on each individual unit. Second, the information collected on a broad range of units across the AEP system provides opportunities to analyze and trend a more robust data set than could be gathered from an individual unit. Third, the information collected from units within the same series and the evaluations performed for one of the units in that series can highlight developing issues and solutions that can be applied to the entire series before equipment damage occurs. And fourth, the MDC staff can develop diagnostic tools and software that is customized to an AEP series of units based on the wealth of information in their systems, without the expense and delays associated with engaging a third party contractor.

For all of these reasons, a commercial neural network would not collect additional data, provide better trending and evaluation, or take advantage of the broader universe of data available at the MDC Sensors or monitor temperatures, pressures, heat rate deviations on certain subsystems, various alarms, and certain market-based conditions. In addition to optimizing steady state operations, these sensors and related controls allow unit operators to make necessary changes in real time when the unit is required to change loads in response to automatic generator control by the regional transmission operator.

The opportunity for heat rate improvements with this technology is measured as a reduction of the typical heat rate increase that occurs over a long period of operating time. It is not an improvement in the design heat rate of the unit. In addition, the sensors, information, and controls must also be accompanied by actions necessary to make meaningful change in performance. While a neural network can expand the data points that are measured and monitored, it ultimately requires actions by both programmed control systems and experienced operators to start/stop and verify equipment operation or modify control settings to make meaningful change in performance. Since much of this work is already being achieved on Welsh Unit 3 through existing sensors and controls and experienced operators, it is expected that addition of a neural network would result in a marginal improvement that is less than the range predicted in Table 1 of the ACE Rule.

Welsh Unit 3 is equipped with an intelligent sootblowing system that was installed during a scheduled unit outage in 2007. The system that was installed is a product of Diamond Power

Company. The sootblowers do not use a neural network or DCS. The sootblowers have the ability to be automatically controlled via the supplied control system or via manual override by unit operators as may be needed. Water lances were installed prior to 1994 to improve cleaning of radiant heat area of the furnace.

Performance measurements to determine the impact of the sootblower systems on unit heat rate were not taken. These systems were installed primarily to reduce the risk of slag formation and potential unacceptable accumulation of ash on the heat transfer surfaces. Any heat rate "improvement" that is realized from these systems is in effect a reduction of the heat rate penalty being experienced against the unit design because of ash/slag buildup. These do not effectively improve the heat rate beyond the original design basis for a "clean" boiler, but when used effectively can maintain heat rate closer to the design value for a longer period of time.

Neural network technology was developed and applied on a "test" basis to some steam generator equipment at other AEP units a decade ago. Reported results of the very controlled tests were highly variable and the technology focused on mainly one aspect (fuel-air distribution within the furnace) of the steam generation process. Testers concluded that the technology did not provide sufficient economic benefit to apply at full scale. Since that time, the implementation of the Mercury and Air Toxics Standards (MATS) rule has introduced increased regularity into the inspection, repair, and tuning of combustion controls. In addition, neural network technology still requires manual coordination of several other processes, including starting and stopping large equipment such as pulverizers and fans, in order to maintain combustion stability within the steam generator. SWEPCO relies on well-trained and highly knowledgeable operators to perform this integrated control in a highly efficient and reliable manner without the use of neural networks. The current use of the sootblowing system on Welsh Unit 3 maintains a high level of steam generator cleanliness and no measureable additive heat rate improvement is anticipated to result from integrating a neural network for this unit.

- *If the measure is not already implemented but is feasible to implement, provide the following information.*
    - *Describe your current equipment and/or system as it relates to the measure.*
    -

See response above. Although technically feasible, the benefits of applying of this technology are limited for the reasons discussed above.

- *Quantify the estimated heat rate improvement potential from baseline, in percent and Btu/KWh.*
- *Quantify the expected decrease in on-site power consumption, in MWh per year, if applicable.*

- *Quantify the cost to implement the measure if it is different than the range provided in Table 2 of the ACE preamble (84 FR 32542). Describe the basis of cost estimates (e.g., vendor estimates, work performed on comparable unit, etc.)*
- *If the measure will require more than two years to implement, provide a schedule with specific dates for increments of progress (40 CFR Part 60, Subpart Ba, §60.24a(d)).*
  - *Awarding contracts of issuing purchase orders*
  - *Start of construction or installation*
  - *Completion of construction or installation*
  - *Final compliance*

Not applicable.

- *If the measure is not already implemented and is not feasible or is limited, provide the following information.*
  - *Describe your current equipment and/or system as it relates to the measure*
  - *Explain why the measure is not feasible or is limited due to the unique characteristics of each unit.*
  - *Specifically address any factors considered in the analysis including remaining useful life of the facility, unreasonable cost of control, physical impossibility of control, or other factors that make application of the measure unreasonable (40 CFR §60.24a(e)).*

See previous responses.

2. Boiler Feed Pump Overhaul or Upgrade

Provide the following for each heat rate improvement measure

- *If the measure is already implemented, provide the following:*
  - *Describe your current equipment and/or system as it relates to the measure including the pump manufacturer's specifications.*

Large electric motor powered boiler feed pumps (BFPs) supply feedwater to the steam generator in some units, and are responsible for a large portion of the auxiliary power consumed within a power plant (up to 10 MW from a 500 MW unit). Rigorous maintenance is required to ensure reliability and efficiency are maintained. Wear reduces the efficiency of the pump operations and requires regular rebuilds/upgrades/overhauls. These improvements for electric boiler feedwater pumps reduce auxiliary power demands and improve *net* heat rate, but would not result in measureable improvements in *gross* heat rate.

At Welsh Unit 3, the main boiler feed pump is manufactured by Pacific Pumps/Dresser and is driven by a steam turbine and not a motor. As such, for most of the operating range of the Units (above 24% output), the boiler feed pump is self-regulating and matches the feedwater needed to the load at which the unit is operating. In addition, the boiler feed pump enhances the overall efficiency of the unit because of the reduced auxiliary electric demand (a reduction of as much as 35% of typical auxiliary load). For startup and low load operations, where there is insufficient steam yet available to supply the auxiliary drive steam turbine, a smaller motor-driven feed pump is used to provide the required feedwater. This pump is initially used during unit startup prior to the electric generator producing any output and is removed from service at approximately 24% load. Boiler feed pump turbines can experience degradation and wear over time, and require periodic maintenance to repair turbine blades, exchange rotors, and restore steam seals. The boiler feed pumps at Unit 3 have been regularly maintained in accordance with the manufacturer's (Pacific Pumps/Dresser) specifications and additional overhauls are unnecessary. The Pacific Pumps/Dresser turbine driven boiler feed pump design specifications are: 9132 GPM, 7384 ft head, 88% efficiency, and 5001 RPM. The motor drive feed pump design points are: 2226 GPM 7384 ft head, 81.5% efficiency, and 3490 RPM

At Welsh Unit 3, a regular turbine overhaul is planned approximately every 10 years, or after 80,000-100,000 hours of service. Given that the original design of these units includes a more efficient technology for use above startup flow conditions, and the operator has adopted a regular schedule for overhauls of the pump and turbine, it is reasonable to conclude that no incremental improvement is currently achievable.

- o *Provide the date the measure was first installed/operated*

The main turbine-driven boiler feed pump was last overhauled and rebuilt in 2017.

- o *If the measure was installed after the baseline period (i.e., years used to determine the baseline rates), quantify the impact on your heat rate, in percent and Btu/KWh.*

Due to the length of time that has passed since this equipment installation, there are no contemporaneous records of unit operating performance maintained by SWEPCO for the requested periods, and heat rate tests were not conducted prior to or after this installation. Given that the original design of these units includes a more efficient technology for use above startup flow conditions, and the operator has adopted a regular schedule for overhauls of the pump and turbine, it is reasonable to conclude that no incremental improvement is currently achievable.

- *If the measure is not already implemented but is feasible to implement, provide the following information.*

- *Describe your current equipment and/or system as it relates to the measure including the pump manufacturer's specifications.*
- *Quantify the estimated heat rate improvement potential from baseline, in percent and Btu/KWh.*
- *Quantify the expected decrease in on-site power consumption, in MWh per year, if applicable.*
- *Quantify the cost to implement the measure if it is different than the range provided in Table 2 of the ACE preamble (84 FR 32542). Describe the basis of cost estimates (e.g., vendor estimates, work performed on comparable unit, etc.)*
- *If the measure will require more than two years to implement, provide a schedule with specific dates for increments of progress (40 CFR Part 60, Subpart Ba, §60.24a(d)).*
    - *Awarding contracts or issuing purchase orders*
    - *Start of construction or installation*
    - *Completion of construction or installation*
    - *Final compliance*

Not applicable.

- *If the measure is not already implemented and is not feasible or is limited, provide the following information.*
    - *Describe your current equipment and/or system as it relates to the measure including the pump manufacturer's specifications.*
    - *Explain why the measure is not feasible or is limited due to the unique characteristics of each unit.*
    - *Specifically address any factors considered in the analysis including remaining useful life of the facility, unreasonable cost of control, physical impossibility of control, or other factors that make application of the measure unreasonable (40 CFR §60.24a(e)).*

See previous responses.

3. Air Pre-Heater and Duct Leakage Control

Provide the following for each heat rate improvement measure

- *If the measure is already implemented, provide the following:*
    - *Describe your current equipment and/or system as it relates to the measure.*
    - *Include the following:*
        - *Description of the type and design, e.g., regenerative vs. recuperative*
        - *Date seals were last replaced, if regenerative*

- *Current estimated air pre-heater leakage rate and method of determination*
- *Estimated improved air pre-heater leakage rate, if implemented.*

The two air pre-heaters installed at Welsh Unit 3 are tri-sector regenerative air heaters which rotate. For this unit, air heater seals are typically inspected, repaired or replaced with in-kind seals during equipment outages when the air heater baskets are replaced or when seals are found damaged. Additionally, the air heater internal ducts and sector plates are inspected during maintenance on the air heater, and localized repairs and stationary seal replacements can be made during those inspections if materials are available, or included in future outage plans.

There are products on the market that advertise lowering the amount of leakage experienced within air pre-heater equipment. While it is likely feasible to install such products on Welsh Unit 3, it is currently AEP's opinion that the newer designs for low-leakage seals present risks to unit reliability and air heater functionality that may outweigh any efficiency gains. A thorough technical review is needed to determine applicability and potential benefits for Welsh Unit 3. Plant operators currently use PI system screens for monitoring differential pressure, temperatures and flue gas pressure in the air heater and motor amps for the PA, FD and ID fans in order to assess air heater loading and performance. Application of the low-leakage seal design would require some level of detailed engineering and design by the boiler and/or air heater OEM(s) to determine a suitable method of application and to determine the potential benefits to be gained and reliability risks to consider in each specific case. A feasibility study has not been performed for this unit. Some leakage at this location is necessary to avoid air heater lock-ups due to excessive thermal expansion caused by temperature excursions.

- *Provide the date the measure was first installed/operated.*

The air heater seals were last replaced as a complete set in 2016 during a scheduled outage. Seals are inspected and maintained on an annual basis in accordance with the manufacturer's recommendations during maintenance outages as recommended by the air heater OEM. This maintenance can include repairs to sealing components or replacement of partial sets of seals as necessary, based on damage or wear. The costs for these inspections and repairs have not been separately tracked.

- *If the measure was installed after the baseline period (i.e., years used to determine the baseline rates), quantify the impact on your heat rate, in percent and Btu/KWh.*

Not applicable.

- *If the measure is not already implemented but is feasible to implement, provide the following information.*
    - *Describe your current equipment and/or system as it relates to the measure.*
    - *Quantify the estimated heat rate improvement potential from baseline, in percent and Btu/KWh.*
    - *Quantify the expected decrease in on-site power consumption, in MWh per year, if applicable.*
    - *Quantify the cost to implement the measure if it is different than the range provided in Table 2 of the ACE preamble (84 FR 32542). Describe the basis of cost estimates (e.g., vendor estimates, work performed on comparable unit, etc.)*
    - *If the measure will require more than two years to implement, provide a schedule with specific dates for increments of progress (40 CFR Part 60, Subpart Ba, §60.24a(d)).*
        - *Awarding contracts of issuing purchase orders*
        - *Start of construction or installation*
        - *Completion of construction or installation*
        - *Final compliance*

Not Applicable.

- *If the measure is not already implemented and is not feasible or is limited, provide the following information.*
    - *Describe your current equipment and/or system as it relates to the measure*
    - *Explain why the measure is not feasible or is limited due to the unique characteristics of each unit.*
    - *Specifically address any factors considered in the analysis including remaining useful life of the facility, unreasonable cost of control, physical impossibility of control, or other factors that make application of the measure unreasonable (40 CFR §60.24a(e)).*

See previous responses.

4. Variable Frequency Drives on Induced Draft Fans and Boiler Feed Pumps

Provide the following for each heat rate improvement measure

- *If the measure is already implemented, provide the following:*
    - *Describe your current equipment and/or system as it relates to the measure.*
    - *Provide the date the measure was first installed/operated*

- *If the measure was installed after the baseline period (i.e., years used to determine the baseline rates), quantify the impact on your heat rate, in percent and Btu/KWh.*
- *Provide Fan and pump manufacturer's specifications*

- *If the measure is not already implemented but is feasible to implement, provide the following information.*
  - *Describe your current equipment and/or system as it relates to the measure.*

Variable Frequency Drives (VFD) are available that work in concert with traditional electric motors to vary the speed necessary during unit load changes to maximize performance of the driven equipment and reduce losses. This results in a reduction of power consumption as an auxiliary load and helps to maximize the net electrical generation from the unit. The most effective applications are for electric driven boiler feed pumps that control feed water flow and induced draft fans that control air/gas flow through the flue gas path.

At Welsh Unit 3, approximately 50 - 60 percent of the electric demand on a typical unit has already been addressed, including both of the major applications for VFDs identified in the ACE rule. First, the main boiler feed pump is designed by Pacific/Dresser and is driven by an auxiliary steam turbine that automatically adjusts to the required load and does not consume electricity. As mentioned above in response to Question 2, the Pacific Pumps/Dresser turbine driven boiler feed pump design specifications are: 9132 GPM, 7384 ft head, 88% efficiency, and 5001 RPM. This pump/turbine combination is placed in service when the unit advances off of the startup system and achieves approximately 24% output and remains in service up through full load.

Second, induced draft (ID) fans were last replaced on the unit in 2016, and are axial vane fans with variable blade pitch, which reduce energy losses, enhance operator control, and increase volumetric flow through the unit to increase efficiency. The ID Fan is an axial vane design that operates at 890 RPM. At the boiler maximum continuous rating point, the axial vane ID fan performance is 1155600 CFM inlet, 32.35 in H_2O static pressure rise, and 84.2% efficiency.

The axial vane fans deliver substantially similar benefits as VFDs. In fact, in its 2009 report on coal-fired power plant heat rate reductions, Sargent & Lundy compared the benefits of centrifugal fans with VFDs to axial vane fans, and determined that the axial vane fans provided slightly superior performance. *Coal-Fired Power Plant Heat Rate Reductions*, Sargent & Lundy, Final Report on Project 12301-001 (Jan. 22, 2009) at p.8-5.

  - *Quantify the estimated heat rate improvement potential from baseline, in percent and Btu/KWh.*

Based on the *Sargent & Lundy* Report, SWEPCO anticipates that any difference in the heat rate to install and operate a VFD for ID fans for both base load and cycling operations would be negligible.

The impact of adopting a VFD to the auxiliary boiler feed pump motor would be extremely low, well below the suggested range offered in the ACE Rule Table 1, as this motor is infrequently used and likely to produce unmeasurable benefits.

- *Quantify the expected decrease in on-site power consumption, in MWh per year, if applicable.*

Similarly, the power differential to operate the axial vane fans versus a conventional centrifugal fan and motor with VFD for both base load and cycling operations is negligible.

- *Quantify the cost to implement the measure if it is different than the range provided in Table 2 of the ACE preamble (84 FR 32542). Describe the basis of cost estimates (e.g., vendor estimates, work performed on comparable unit, etc.)*

During the 2019 unit maintenance outage, the boiler feedpump turbine (BFPT) was replaced with a spare from the retired Unit 2, due to a previous last stage blade failure on the Unit 3 BFPT. Steam path repairs were completed, and BFPT packing and internal seal replacement was performed to restore internal clearances.

As mentioned above, Welsh Unit 3 was able to install axial vane variable flow fans for the ID fan applications when the baghouses were installed in 2016. SWEPCO does not have a true cost for adding a VFD onto an existing induced draft centrifugal fan. The axial vane fans were part of the larger baghouse equipment project in 2016.

Application of a VFD to the auxiliary boiler feed pump drive motor would likely be cost prohibitive since the motor is approximately 5,000 HP, operates for a limited time only during startup when feed water flow is low and controlled by a regulating valve and the electric generator is not yet connected to the grid (producing 0 MWs). Occasionally the auxiliary feed pump may be brought into service during unit load reduction with the generator producing low MWs for short periods of time (hours) to perform troubleshooting or testing of the main BFD or drive turbine. This period would likely not be part of the emissions performance standard period of testing.

- *If the measure will require more than two years to implement, provide a schedule with specific dates for increments of progress (40 CFR Part 60, Subpart Ba, §60.24a(d)).*
  - *Awarding contracts of issuing purchase orders*
  - *Start of construction or installation*
  - *Completion of construction or installation*

- *Final compliance*

As discussed above, implementing this measure is likely cost prohibitive and would result in no measureable heat rate improvement over the current equipment.

- *If the measure is not already implemented and is not feasible or is limited, provide the following information.*
  - *Describe your current equipment and/or system as it relates to the measure*
  - *Explain why the measure is not feasible or is limited due to the unique characteristics of each unit.*
  - *Specifically address any factors considered in the analysis including remaining useful life of the facility, unreasonable cost of control, physical impossibility of control, or other factors that make application of the measure unreasonable (40 CFR §60.24a(e)).*

See previous responses.

5. Blade Path Upgrades for Steam Turbines

Provide the following for each heat rate improvement measure

- *If the measure is already implemented, provide the following:*
  - *Describe your current equipment and/or system as it relates to the measure and include the turbine manufacturer's specifications.*

The best candidates for blade path upgrades are those turbines experiencing steam leaks and blade erosion, where efficiency improvements can be achieved using computerized flow modeling and innovative materials. However, significant variation exists among units. These upgrades are large capital investments and require long lead times.

Welsh Unit 3 is equipped with one combined and opposed-flow high pressure/intermediate pressure (HP/IP) turbine and two low pressure (LP) turbines. This unit has the same turbine design as Welsh Unit 1. A set of rotor spares is available from the retired Welsh Unit 2.

  - *Provide the date the measure was first installed/operated*

The steam turbine on Welsh Unit 3 has not been upgraded in the last 10 years. The steam turbine has been overhauled during the last 10 years. Steam turbine sections were last overhauled in 2017 for the HP/IP turbine and in 2015 for the LP turbines.

During the 2015 and 2017 unit maintenance outages, the turbines were overhauled by opening and assessing condition, cleaning and removal of blade deposits, inspection and non-destructive testing of components, repairing of worn or damaged blades with like-kind materials and restoration of seals to design clearance values. Closing clearances were recorded and the turbine casings reassembled. Rotor vibration levels are monitored during startup to determine no rubs occur and rotor balance is acceptable. Steam pressures and temperatures are measured to confirm proper steam expansion is taking place.

- *If the measure was installed after the baseline period (i.e., years used to determine the baseline rates), quantify the impact on your heat rate, in percent and Btu/KWh.*

As a result of the turbine overhaul, most of the "recoverable" losses that occur during the normal operating cycle of the steam turbine sections were reduced and overall performance moved closer to design values. A formal heat rate test utilizing highly calibrated test instruments is not typically performed following a turbine overhaul as this is not cost effective. Improvement is typically measured with installed station instrumentation by a reduction in feedwater flow and steam generator heat input for a given MW production as corrected to standard throttle conditions.

- *If the measure is not already implemented but is feasible to implement, provide the following information.*

  - *Describe your current equipment and/or system as it relates to the measure.*

See responses above. In addition, there are steam path upgrades that have been applied to similar units. Typically a steam path upgrade is only cost-justified if other changes to a unit will significantly increase auxiliary loads, and some of those losses can be offset by the turbine upgrade. The baghouse design used at Welsh Unit 3 does not increase auxiliary power demands as much as conventional wet or dry scrubbers, so the investment was not justified when those controls were installed. Currently, demand for electricity is not growing at a rapid pace, and other alternatives for additional generating capacity can be more economically attractive than increasing the output of a coal-fired unit. An economic evaluation for any potential steam path upgrade is recommended. These factors, and the potential to trigger NSR review, would need to be carefully considered in addition to whether a turbine upgrade would fall within the range of the ACE Rule Table 1 estimates as well as the Table 2 range for HR improvement.

  - *Quantify the estimated heat rate improvement potential from baseline, in percent and Btu/KWh.*

Regular overhauls restore and maintain the efficiency of the unit. No specific upgrade designs have been developed for Welsh Unit 3, and therefore the heat rate impact cannot be estimated.

- *Quantify the expected decrease in on-site power consumption, in MWh per year, if applicable.*

- *Quantify the cost to implement the measure if it is different than the range provided in Table 2 of the ACE preamble (84 FR 32542). Describe the basis of cost estimates (e.g., vendor estimates, work performed on comparable unit, etc.)*

The cost of a turbine overhaul or upgrade can vary significantly based on the amount of damage to or degradation of existing components (for an overhaul), or the extent of any design changes associated with an upgrade. Some upgrades may require replacement of turbine rotors, blade carriers and casings in addition to the blades, at a substantially increased cost and scope of work. No specific upgrades have been designed or estimated for the turbines at Welsh.

Steam turbine overhauls and steam path inspections/repairs have been performed at Welsh Unit 3 over the years to return the turbine to near design conditions. These were performed during scheduled outages when turbine inspections have allowed for any liabilities to be addressed and for replacement parts to be procured and made ready for installation. AEP is not aware of any commercial offerings from the turbine OEM for steam path upgrades for Welsh Unit 3. The next regular maintenance opportunity for this turbine is not until 2028 or later.

- *If the measure will require more than two years to implement, provide a schedule with specific dates for increments of progress (40 CFR Part 60, Subpart Ba, §60.24a(d)).*
  - *Awarding contracts of issuing purchase orders*
  - *Start of construction or installation*
  - *Completion of construction or installation*
  - *Final compliance*

- *If the measure is not already implemented and is not feasible or is limited, provide the following information.*
  - *Describe your current equipment and/or system as it relates to the measure*
  - *Explain why the measure is not feasible or is limited due to the unique characteristics of each unit.*
  - *Specifically address any factors considered in the analysis including remaining useful life of the facility, unreasonable cost of control, physical impossibility of control, or other factors that make application of the measure unreasonable (40 CFR §60.24a(e)).*

See above responses.

6. Redesign or Replacement of Economizer

Provide the following for each heat rate improvement measure

- *If the measure is already implemented, provide the following:*
  - *Describe your current equipment and/or system as it relates to the measure.*
  - *Provide the date the measure was first installed/operated*
  - *If the measure was installed after the baseline period (i.e., years used to determine the baseline rates), quantify the impact on your heat rate, in percent and Btu/KWh.*

Not applicable.

- *If the measure is not already implemented but is feasible to implement, provide the following information.*
  - *Describe your current equipment and/or system as it relates to the measure.*

Replacing or redesigning the economizer can optimize temperatures at the exit of the boiler. Boiler layout and construction may limit the applicability of this measure to certain units.

The economizer on Welsh Unit 3 is original and has never been replaced. On occasion, there has been a need to locate and access certain areas of the economizer to address leaking tubes or other physical damage. This repair could result in replacement of a small number of tubes or partial tube sections but no major replacement of tube bundles has been necessary.

During the past year the economizer has performed well, allowing for critical temperatures such as boiler exit gas and air heater gas outlet temperatures to remain within manufacturer specifications throughout the load range.

Because there are currently no issues with the performance of the existing economizer, and no specific design changes have been identified that would allow the unit to increase efficiency without potentially compromising the operations of downstream equipment, there are no known changes to evaluate.

It is technically feasible to replace an economizer either with like-kind design or with some improvements in materials or heat transfer characteristics. Limited like-kind replacements of economizer sections have been made to repair tube damage with no impact to the heat rate of the unit. However, making changes to the economizer design or replacing the economizer in its entirety would have significant impacts on downstream equipment at this unit, including the air heaters, which are sensitive to flue gas temperature changes. The existing economizer is functioning well in its current cycle and condition and does not warrant replacement.

- *Quantify the estimated heat rate improvement potential from baseline, in percent and Btu/KWh.*

For the reasons expressed in the previous answer, there are no heat rate improvements anticipated to be associated with an economizer redesign/replacement project.

- *Quantify the expected decrease in on-site power consumption, in MWh per year, if applicable.*

- *Quantify the cost to implement the measure if it is different than the range provided in Table 2 of the ACE preamble (84 FR 32542). Describe the basis of cost estimates (e.g., vendor estimates, work performed on comparable unit, etc.)*

No specific designs have been identified that would allow the impacts or costs of this measure to be estimated.

- *If the measure will require more than two years to implement, provide a schedule with specific dates for increments of progress (40 CFR Part 60, Subpart Ba, §60.24a(d)).*
  - *Awarding contracts of issuing purchase orders*
  - *Start of construction or installation*
  - *Completion of construction or installation*
  - *Final compliance*

- *If the measure is not already implemented and is not feasible or is limited, provide the following information.*
  - *Describe your current equipment and/or system as it relates to the measure*
  - *Explain why the measure is not feasible or is limited due to the unique characteristics of each unit.*
  - *Specifically address any factors considered in the analysis including remaining useful life of the facility, unreasonable cost of control, physical impossibility of control, or other factors that make application of the measure unreasonable (40 CFR §60.24a(e)).*

See previous responses.

7. Heat Rate Improvement Best Management) O& M Practices

Provide the following for each heat rate improvement measure

- *If the measure is already implemented, provide the following:*
    - *Describe your current equipment and/or system as it relates to the measure and include a description of the current O&M practices for the following, if performed, including frequency: staff training in heat rate improvement practices; On-site heat rate performance appraisals; steam surface condenser cleaning.*

Heat rate improvement "awareness training" is suggested as a means of elevating awareness of specific heat rate improvement efficiency measures among the operations and maintenance staff at units including the Welsh Plant affected by the rule. In the response to ACE Rule comments, EPA recognized that the level of awareness at individual units could vary dramatically, and that states might simply take into consideration whether there are existing programs at specific units as part of the overall evaluation of the candidate technologies. Capital costs are anticipated to be minimal and the impact of implementing new or existing programs is difficult to estimate and expected to be widely variable.

As generating units across the country have joined regional transmission organizations and begun offering the output of their units into competitive generation markets, cost-effective operation of individual units has become increasingly important. AEP units in the west are dispatched as part of SPP (Southwest Power Pool) which has a robust day-ahead energy market. As a result, increasing attention has been focused on ways to improve efficiency and lower operating costs.

AEP provides training, monitoring tools, and "best practice" sharing forums for its employees as a way to help plant operators and staff to improve their awareness and equip them with means to maintain efficient operations and identify further efficiency improvements. Some of these tools and practices include:

- Operator training
- HRI classes, focusing on plant system optimization, are held at the Generation unit simulator center in St. Albans, WV and available to Welsh Unit 3 personnel
- An automated Monitoring & Diagnostics Center
- Equipment control systems capable of automatically responding to changing conditions
- Regular technology updates and reviews

- Participating in and contributing to AEP Operational Excellence Program for best practices, including maximizing performance and reducing heat rate
- Maintaining thermal performance models of the unit design cycle with equipment references
- MDC performs start-up and shutdown analyses related to thermal ramp rates for Welsh Unit 3 boiler tubes/headers, heaters and turbine components with the goal of reducing equipment degradation, improved long-term performance, and reliability.

The degree to which individual unit operators, supervisors and engineers undergo various parts of this training depends upon their position and desire to further develop and take on additional responsibilities. Some positions such as a Control Center Operator (CCO) requires prior successful completion of the NUS Heat Rate course. The CCO is also responsible to monitor "controllable" heat rate monitor screens in the unit control room to aid in determining the most efficient unit operation conditions for Welsh Plant.

The Welsh Plant performs heat rate performance appraisals on an ongoing basis. The plant monitors heat rate deviations on an ongoing basis though their PI system (as described in response to question 1 above), and initiates corrective action when warranted.

The Welsh Plant performs condenser tube leak checks during every maintenance outage to address any leaking tubes in order to maintain optimum performance and reduce the effects of contamination. Condenser tube cleanings are performed when performance monitoring indicates the need. Condenser tube fouling has not typically been a problem on Welsh Unit 3, but when it occurs it has typically been caused by clam shells blocking the flow of cooling water in the tubes. This condition is effectively resolved by back washing during outages. We monitor performance by examining the relationship between cooling water temperature and condenser pressure during different seasonal periods. This relationship has tracked closely with the design parameters. The MDC has several models built around condenser performance which are closely monitored. The current cleaning methods are working well, and the quality of the cooling water and steam purity in the condensate cycle are being held close to optimum values. The last time the main and auxiliary condensers required cleaning to remove scale buildup was in 2008.

- *Provide the date the measure was first installed/operated*

Not applicable.

- *If the measure was installed after the baseline period (i.e., years used to determine the baseline rates), quantify the impact on your heat rate, in percent and Btu/KWh.*

Existing programs and measures are currently being employed and improvements are reflected in the historic emissions data for this unit. The precise percentage in unknown. No quantifiable incremental increase in heat rate improvement is anticipated as a result of continuing the existing practices, which include regular technology reviews and updates

- *If the measure is not already implemented but is feasible to implement, provide the following information.*
  - *Describe your current equipment and/or system as it relates to the measure.*
  - *Quantify the estimated heat rate improvement potential from baseline, in percent and Btu/KWh.*
  - *Quantify the expected decrease in on-site power consumption, in MWh per year, if applicable.*
  - *Quantify the cost to implement the measure if it is different than the range provided in Table 2 of the ACE preamble (84 FR 32542). Describe the basis of cost estimates (e.g., vendor estimates, work performed on comparable unit, etc.)*
  - *If the measure will require more than two years to implement, provide a schedule with specific dates for increments of progress (40 CFR Part 60, Subpart Ba, §60.24a(d)).*
    - *Awarding contracts of issuing purchase orders*
    - *Start of construction or installation*
    - *Completion of construction or installation*
    - *Final compliance*

Not applicable.

- *If the measure is not already implemented and is not feasible or is limited, provide the following information.*
  - *Describe your current equipment and/or system as it relates to the measure*
  - *Explain why the measure is not feasible or is limited due to the unique characteristics of each unit.*
  - *Specifically address any factors considered in the analysis including remaining useful life of the facility, unreasonable cost of control, physical impossibility of control, or other factors that make application of the measure unreasonable (40 CFR §60.24a(e)).*

Not applicable.

Recommended Final Standards for State Plan – 40 CFR 60.5755a

Provide the expected heat rate and recommended CO2 emission standard(s) for each designated facility after implementation of all HRI measures determined to be feasible. Section 60.5755a(a)(1) of the ACE rule requires the standard of performance for each designated facility be an emission performance rate relating mass of CO2 emitted per unit of energy (e.g., lb CO2/MWh). The EPA has indicated that work practice standards cannot be used in lieu of establishing a numerical limit for any of the measures, including those measures that only impact net generation. The ACE rule does not allow for parametric monitoring, mass-based limits, concentration-based limits, or a trading program.

Step 1

• *Expected heat rate in Btu/KWh after implementation of all measures recommended as feasible, gross and/or net basis*

• *Recommended CO2 lb/MWh emission standards, gross and/or net basis*

o *Recommended emission limits based on percent reduction in CO2 baseline rate, as determined above, by applying percent improvement from BSER measures determined to be feasible*

o *Rolling 12-boiler operating month compliance basis, or alternative basis, calculated similar to baseline rate*

o *If separate standards are recommended based on different operating loads, clearly identify the operating load criteria associated with each segment (e.g., firing rate capacity associated with each segment) Affordable Clean Energy Rule State Plan Company Information Collection Request February 24, 2020 Page 5 of 5*

o *Provide any suggestions on how to address measures that only affect net generation.*

Step 2

• *Detailed justification for recommended final standards, which may consider remaining useful life of the facility and other factors such as unreasonable cost of control, physical impossibility of control, or other factors that make application of the measure unreasonable (40 CFR §60.24a(e)).*

• *If you are relying on remaining useful life as part of the justification for the final recommended standard, provide the following information.*

o *Number of years the unit is expected to continue operating beyond 2019 given current economic conditions*

o *Basis of estimated remaining useful life* *o Feasibility of making a federally enforceable commitment to a future retirement date.*

Ongoing evaluations under other recently finalized federal environmental regulations have not yet been completed, and will impact the baseline evaluation and projected future emissions and operating conditions. TCEQ has extended the time to complete this section of the ICR response until December 15, 2020.

Additional Information

• *Description of any future expected overhauls or equipment replacements not already accounted for in measures listed above that would be needed to maintain unit heat rate and CO2 emission rate beyond initial compliance, e.g., shortened equipment life resulting in more frequent replacement and additional costs*

• *Description of any future potential installations of environmental control equipment that would increase the on-site parasitic load, including resulting estimated potential increase in on-site electricity use in MWh per year Facility*

Future Operational Information—40 CFR §60.5740a(4)(i)(A)–(F)

Responses regarding future operational characteristics can be based on publicly available information rather than potentially confidential company-specific information, if you provide the source of the publicly available information (e.g., DOE data, information provided by utilities to the applicable regional transmission organization and/or independent system operator).

• *Summary of each designated facility's anticipated future operational characteristics and basis of estimation*

o *Annual gross and net generation, MWh*

o *Annual CO2 emissions, in tons*

o *Fuel use, prices, and carbon content*

o *Fixed and variable O & M costs*

o *Heat rates*

o *Electric generating capacity and capacity factors*

• *Future operational characteristics should be provided for 2025, 2030, and 2035. For units with an expected retirement date earlier than 2035, data only needs to be provided for those five-year intervals prior to the expected retirement date.*

Ongoing evaluations under other recently finalized federal environmental regulations have not yet been completed, and will impact the baseline evaluation and projected future emissions and operating conditions. TCEQ has extended the time to complete this section of the ICR response until December 15, 2020.

Affordable Clean Energy Rule State Plan
Company Information Collection Request

Supplemental Responses of
Southwestern Electric Power Company

Welsh Unit 3

Submitted December 15, 2020

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Welsh Unit 3

Southwestern Electric Power Company (SWEPCO) submits the following information in response to the information collection request sent by the Deputy Director of the Office of Air Quality at the Texas Commission on Environmental Quality (TCEQ) on February 25, 2020. SWEPCO appreciates the opportunities provided by TCEQ to engage with the Office of Air Quality during the preparation of these responses, and would be happy to meet with TCEQ representatives to discuss any questions regarding them or any further information needs the agency may have.

SWEPCO's initial responses were submitted to the agency on October 30, 2020. At that time, ongoing evaluations of compliance alternatives for the Coal Combustion Residuals Rule (CCR Rule) and the Effluent Limitation Guidelines (ELGs) at Welsh Units 1 and 3 were underway. On November 30, 2020, SWEPCO submitted a request to extend the time to initiate closure of the unlined bottom ash impoundment at the Welsh Plant until October 17, 2028, and committed to cease combusting coal at these units by that date. This revised submittal includes additional information in response to TCEQ's requests for Basic Information about the Welsh Units, Recommended Final Standards for the State Plan, Additional Information, and Future Operational Information. These supplemental responses are intended to replace the initial responses in their entirety.

Basic Information:

Please provide the baseline carbon dioxide (CO_2) emissions rate and baseline heat rate for each designated facility. Provide the baseline information for different load segments if you are recommending separate standards based on different operating loads. Baseline calculations should include data from all operations during the selected baseline period.

Use default equation or supply data, calculations, and justification for a different approach.

Provide a detailed justification for selected period.

Provide Design firing rate capacity in MMBtu/hr for full load.

Provide Nameplate, summer, and winter generation capacity in MW, if changed since most recent DOE Energy Information Administration Form 860 submittal.

Welsh Unit 3 design firing rate capacity is 5159 MMBtu/hour based on Babcock & Wilcox ("B&W") design specifications for boiler maximum continuous rating (MCR) point.

The most recent DOE Energy Information Administration Form 860 lists the capacity of Welsh Unit 3 as 528 MW for the maximum summer and winter rating, and 150 MW for the minimum summer and winter rating.

Historical hourly data for the default period is presented in Figure 1 below using data from calendar years 2016 through 2019. The data is derived from all valid unbiased flow measurements collected using the unit's certified monitoring system using the procedures required by 40 CFR Part 60 whenever the unit was combusting fuel. Hours when the unit was combusting fuel but not generating electricity were manually adjusted to substitute a value of 1 MW gross output for each zero. This affected a total of 328 operating hours, or 1.125% of the total 29,146 operating hours for this unit in the 2016-2019 period. Figure 1 includes monthly average heat rates and CO_2 emission rates, rolling 12-month average heat rates and CO_2 emission rates, and a "baseline" rate for the 24-month period in 2017-2019, calculated as the average of the 12-month rolling averages in 2017-2018, and 2018-2019, plus three standard deviations. As discussed below, SWEPCO does not endorse the approach of selecting a single simple average as the basis for final standards in the state plan. More detail regarding the selection of a recommended standard is in the later sections of this response.

Figure 1: Baseline Data

Year	Month	Part 60 - Unsubstituted Heat Input (MMBtu)	Part 60 - Unbiased (Short tons)	Enviance - Gross MWH	Rolling 12-month CO2 Emission Rate (lb/MWh)	Baseline CO2 Emisssion Rate (lb/MWh)	Rolling 12-Month Heat Rate (Btu/KWh)	Baseline Heat Rate (Btu/KWh)
2016	1	0	0.00	0				
2016	2	0	0.00	0				
2016	3	123940.00	13000.59	92385.00				
2016	4	2010100.00	210910.64	192178.00				
2016	5	1540539.00	161616.79	145007.00				
2016	6	2479476.00	260109.23	240612.00				
2016	7	2456752.00	257820.06	236470.00				
2016	8	2901845.00	304410.77	278407.00				
2016	9	2444021.00	256350.06	237883.00				
2016	10	1006741.00	105589.98	97170.00				
2016	11	2657853.00	278788.64	259896.00				
2016	12	3619944.00	379655.86	353506.00				
2017	1	3188403.00	334431.45	311331.00	2089		9956	
2017	2	2606564.00	273373.42	254387.00	2096	2197	9992	10030
2017	3	200356.00	21436.42	19642.00	2101		10016	
2017	4	835548.00	87714.64	80175.00	2166		10323	
2017	5	2079663.00	218198.94	205366.00	2164		10315	
2017	6	2672761.00	280363.36	264093.00	2158		10283	
2017	7	3415794.00	358244.16	336850.00	2154		10264	
2017	8	3231850.00	338952.50	316121.00	2148		10238	
2017	9	748626.00	78514.65	73456.00	2144		10218	
2017	10	806054.00	84596.78	77652.00	2143		10212	
2017	11	3072804.00	322273.11	306454.00	2142		10211	
2017	12	2198296.00	320203.21	304465.00	2138		10188	
2018	1	2797631.00	293413.00	277245.00	2132		9826	
2018	2	1058968.00	111157.52	104168.00	2128		9804	
2018	3	1420198.00	148994.53	134252.00	2126		9772	
2018	4	2555591.00	268238.99	247293.00	2131		9813	
2018	5	2753003.00	288737.05	267082.00	2133		9843	

2018	6	2796907 00	293335 89	271591 00	2136		9867	
2018	7	2992614 00	313862 32	286840 00	2140		9886	
2018	8	2855152 00	299470 08	275397 00	2147		9912	
2018	9	2504158 00	262632 01	242543 00	2150		9923	
2018	10	1292439 00	135573 50	126650 00	2152		9950	
2018	11	2369252 00	248485 54	230484 00	2150		9950	
2018	12	3406638 00	357284 47	330268 00	2156		9969	
2019	1	2841077 00	297967.02	276074.00	2163		10309	
2019	2	2376973 00	249293.44	231137.00	2167	2207	10329	10111
2019	3	2760693 00	289538 75	269984.00	2167		10332	
2019	4	1837354 00	193062 41	176553.00	2163		10311	
2019	5	2039258 00	213922.08	194139.00	2164		10315	
2019	6	2175476 00	228786 20	204030.00	2167		10328	
2019	7	2243871 00	235392 61	212700.00	2173		10355	
2019	8	2323801 00	243747.31	221094.00	2174		10362	
2019	9	1677713 00	175985.51	163231.00	2177		10374	
2019	10	357695 00	37524 95	35035.00	2177		10372	
2019	11	2344620 00	245907 03	227518 00	2178		10378	
2019	12	2173865 00	227991 78	208129.00	2178		10381	

Output of this unit varies with market conditions, weather, unit conditions and operating characteristics, some of which vary seasonally. These conditions and characteristics are very dynamic and change frequently. Unit operators in the Southwest Power Pool (SPP) region schedule unit loads in coordination with the regional balancing authority to respond to market conditions. Some of the most significant variables affecting market conditions are fuel prices, renewable resource availability, capacity needs, and weather. Changes in these conditions are unpredictable and cannot be controlled by individual unit operators. Since CO_2 emission rates vary with load, all of these sources of variability must be taken into account in establishing a performance standard.

The tables below provide information about the CO_2 emission rate when Welsh Unit 3 operated at various load ranges during the baseline period. These data exclude hours during which there was no electricity being generated or the unit was operating below its minimum stable operating load. Excluding these values eliminates artificially high CO_2 emission rates when there is no electrical output and during the inherently less efficient operations as the unit is achieving minimum stable operating loads. It is no surprise that at lower loads the heat rate is higher, as the unit is designed to operate most efficiently at full load. As noted above, these periods of low load operations have become more prevalent in recent years.

Figure 2: Welsh Unit 3 CO_2 Emission Rates at Various Loads 2016-2018

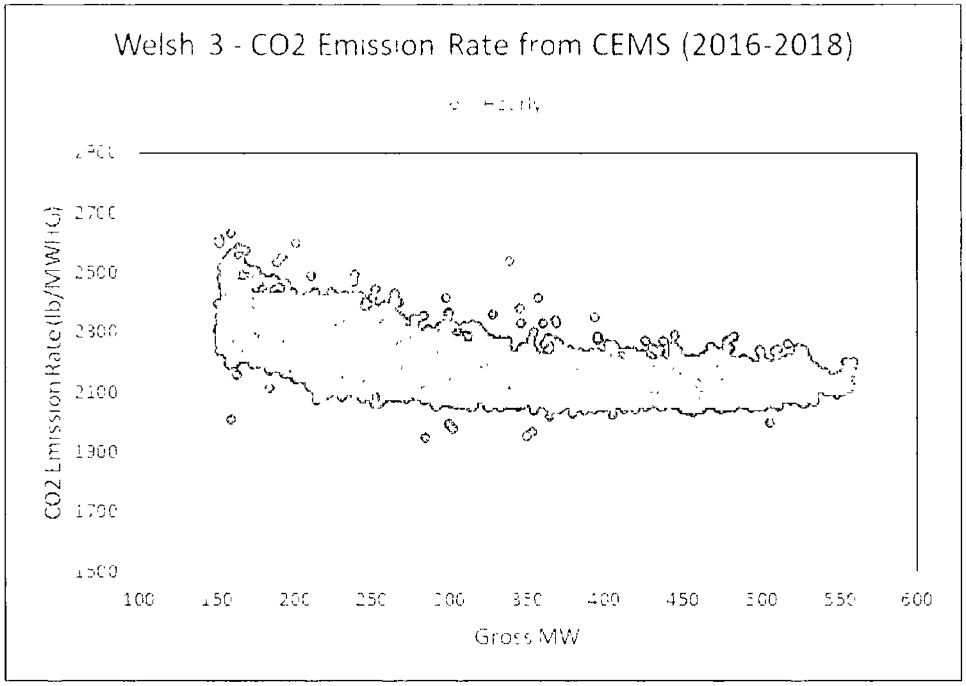
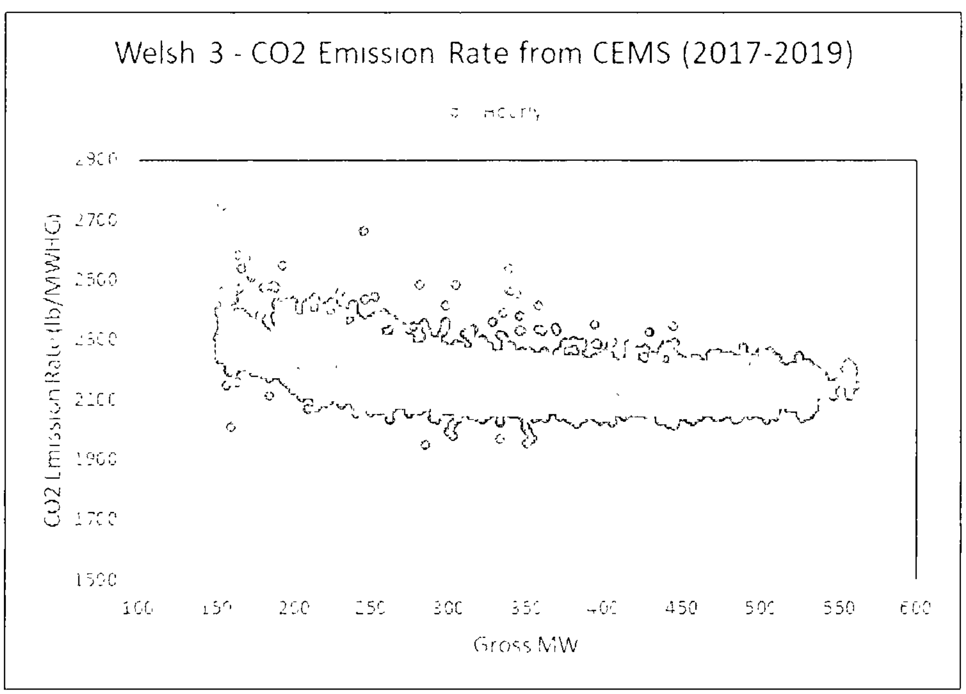
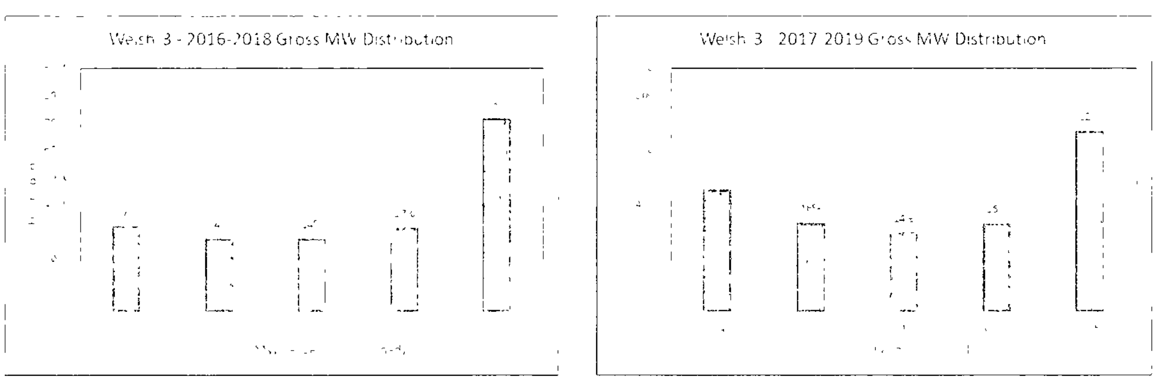


Figure 3: Welsh Unit 3 CO_2 Emission Rates at Various Loads 2017-2019



Coal-fired units are being asked to dispatch at lower loads for longer periods of time in order to be ready to ramp up when intermittent renewable resources become unavailable. Therefore, the default methodology suggested by TCEQ for establishing a baseline emission rate may not be appropriate if a unit is routinely being asked to operate at low loads for long periods of time, or if the unit is being asked to start-up and shutdown much more frequently than was the case during the baseline period. Figure 4 shows the distribution of hours of operation at various load ranges for Welsh Unit 3 during the three-year periods from 2016-2018 and from 2017-2019. While these years contain similar distributions of operating hours, low load operations increased in the later period. Future operations cannot be predicted with any high degree of accuracy. SWEPCO suggests a methodology to establish baseline rates and determine compliance that accommodates changes in unit loads in later sections of this response.

Figure 4: Distribution of Operating Hours at Welsh Unit 3



Heat Rate Improvement Measures

The company must assess the feasibility of each of the EPA's seven heat rate improvement measures for each designated facility. Companies should review the EPA's ACE rule preamble and referenced technical support documents for additional details on each measure. If separate standards are recommended based on different operating loads, assess the feasibility of the measures at each segment.

Cost Information requested can be based on the cost information included in the EPA's ACE rule preamble and/or referenced technical support documents or other cost data may be provided. Reference the basis for any other cost data provided (e.g., vendor estimates, the EPRI Cost Manual Estimator, or the EPA Pollution Control Cost Control Cost manual).

1. **Neural Networks and Intelligent Sootblowers**

Provide the following for each heat rate improvement measure:

- *If the measure is already implemented, provide the following:*
  - *Describe your current equipment and/or system as it relates to the measure.*
  - *Provide the date the measure was first installed/operated.*
  - *If the measure was installed after the baseline period (i.e., years used to determine the baseline rates), quantify the impact on your heat rate, in percent and Btu/KWh.*

Welsh Unit 3 utilizes a Distributed Control System (DCS) and Process Information (PI) monitoring systems to provide the unit operators with a full view of the critical operating conditions on the unit. The DCS and PI together are the functional equivalent of a Neural Network. Welsh Unit 3 also utilizes a Diamond Power Intelligent Soot blowing system.

In the ACE Rule, a neural network is defined as a computer model that can be used to optimize combustion conditions, steam temperatures, and air pollution controls at a steam generating unit. A number of computerized systems have been developed and marketed by vendors, each of which contains a specific suite of sensors and monitors, and each of which is designed to work with specific modeling software based on the fundamental engineering principles that apply to the combustion or steam conditions at that particular unit, and the specific air pollution controls that have been installed at the unit.

The PI and DCS systems at Welsh Unit 3 rely on the same types of monitors and sensors included in most Neural Network packages. Over a hundred different parameters from various systems and equipment are measured across the unit. These include primary and secondary air flows and temperatures, air and gas pressures and flows, pressure differentials for certain critical equipment, auxiliary loads, feedwater flow, fan speeds and pitch, and other measurements.

Subsystems that are monitored and evaluated include the air heaters, pulverizers, burners, fans, dampers, feedwater heaters, reheaters, economizers, superheaters, boiler feed pumps, turbines, generators, air pollution control equipment, condenser systems, and electrical systems.

A neural network installation collects and evaluates the information from sensors installed on a single unit or small group of units at a single location, and recommends adjustments, triggers alarms or sends other notifications to the unit operators, or automates certain functions through the computer tracking and predictive software. Operators can respond and make adjustments as appropriate, investigate unusual conditions, or enter work orders into the plant maintenance system. The PI and DCS systems at Welsh Unit 3 provide similar information to unit operators, adjust certain controls automatically, and can generate alarms and prompt specific actions to be manually performed.

In addition, SWEPCO is one of six operating subsidiaries in the American Electric Power (AEP) system that own and operate fossil fueled-units. The AEP system includes over 30,000 MW of generating capacity, approximately 5,300 MW of which is renewable energy capacity. AEP companies operate approximately 12,000 MW of coal-fired capacity. Among the coal-fired units on the AEP system, there are several "series" of like-sized units of similar design.

The similarities in size and design of the various AEP series of units have made information sharing and performance tracking a hallmark of AEP's culture. In the 1970s, AEP developed a training center for unit operators, and equipped it with a generator simulator that mimicked the real experience of manning the unit controls at one of the system's plants. This in turn led to the creation of a centralized Monitoring & Diagnostics Center (MDC) in 2014, co-located with the training center in St. Albans, West Virginia.

At the MDC, thousands of instrument readings from the majority of the AEP fossil fleet are gathered and monitored. The information comes directly from the PI and DCS systems in real time. Information about sensor conditions and status and data trending and evaluation through the use of pattern recognition software allow the center to notify plant personnel of the need to check, replace, or repair individual sensors, or take other actions to respond to abnormal operating conditions. The MDC has built numerous models around critical processes within the AEP units, and is able to communicate and collaborate with plant and system operators to investigate and remedy conditions before equipment damage occurs. In a sense, the MDC serves as a virtual fleet-wide neural network for AEP's fossil units.

The MDC has the capability to monitor and trend individual data points remotely in real time, spot early trends, and proactively recommend actions to improve performance or eliminate a curtailment before costly damage occurs. Based on the information available through these systems, operators are able to distinguish between controllable and uncontrollable factors impacting heat rate on the unit, and take prescribed actions to reduce the impacts associated with controllable factors as much as physically and economically possible. Intensive operator training, including the use of a centralized control system generator simulator during that training, provides our personnel with the knowledge necessary to initiate appropriate changes in operating parameters, and monitor the effects of automated responses in certain supplemental control systems, to assure that stability is achieved and maintained during all operating conditions.

The capabilities of the MDC are essentially equivalent to the capabilities of a neural network on an individual unit, but with several distinct advantages not present with third party systems. First, the centralized function at MDC reduces the personnel and expense that would be required to support neural networks on each individual unit. Second, the information collected on a broad range of units across the AEP system provides opportunities to analyze and trend a more robust data set than could be gathered from an individual unit. Third, the information collected from units within the same series and the evaluations performed for one of the units in that series can highlight developing issues and solutions that can be applied to the entire series before equipment damage occurs. And fourth, the MDC staff can develop diagnostic tools and software that is customized to an AEP series of units based on the wealth of information in their systems, without the expense and delays associated with engaging a third party contractor.

For all of these reasons, a commercial neural network would not collect additional data, provide better trending and evaluation, or take advantage of the broader universe of data available at the MDC, and therefore would not produce any detectable heat rate improvement beyond that achieved using the current systems and assistance of the MDC. In addition to optimizing steady state operations, these sensors and related controls allow unit operators to make necessary changes in real time when the unit is required to change loads in response to automatic generator control by the regional transmission operator.

The opportunity for heat rate improvements with this technology is measured as a reduction of the typical heat rate increase that occurs over a long period of operating time. It is not an improvement in the design heat rate of the unit. In addition, the sensors, information, and controls must also be accompanied by actions necessary to make meaningful change in performance. While a neural network can expand the data points that are measured and monitored, it ultimately requires actions by both programmed control systems and experienced operators to start/stop and verify equipment operation or modify control settings to make meaningful change in performance. Since much of this work is already being achieved on Welsh Unit 3 through existing sensors and controls and experienced operators, it is expected that addition of a neural network would result in a marginal improvement that is less than the range predicted in Table 1 of the ACE Rule.

Welsh Unit 3 is equipped with an intelligent sootblowing system that was installed during a scheduled unit outage in 2007. The system that was installed is a product of Diamond Power Company. The sootblowers have the ability to be automatically controlled via the supplied control system or via manual override by unit operators as may be needed. Water lances were installed prior to 1994 to improve cleaning of the radiant heat area of the furnace.

Performance measurements to determine the impact of the sootblower systems on unit heat rate were not taken. These systems were installed primarily to reduce the risk of slag formation and potential unacceptable accumulation of ash on the heat transfer surfaces. Any heat rate "improvement" that is realized from these systems is in effect a reduction of the heat rate penalty being experienced against the unit design because of ash/slag buildup. These do not effectively improve the heat rate beyond the original design basis for a "clean" boiler, but when used effectively can maintain heat rate closer to the design value for a longer period of time.

Neural network technology was developed and applied on a "test" basis to some steam generator equipment at other AEP units a decade ago. Reported results of the very controlled tests were highly variable and the technology focused on mainly one aspect (fuel-air distribution within the furnace) of the steam generation process. Testers concluded that the technology did not provide sufficient economic benefit to apply at full scale. Since that time, the implementation of the Mercury and Air Toxics Standards (MATS) rule has introduced increased regularity into the inspection, repair, and tuning of combustion controls. In addition, neural network technology still requires manual coordination of several other processes, including starting and stopping large equipment such as pulverizers and fans, in order to maintain combustion stability within the steam generator. SWEPCO relies on well-trained and highly knowledgeable operators to perform this integrated control in a highly efficient and reliable manner, supported by the existing PI and DCS systems and the MDC. The current use of the sootblowing system on Welsh Unit 3 maintains a high level of steam generator cleanliness and no measureable additive heat rate improvement is anticipated to result from integrating a neural network for this unit.

- *If the measure is not already implemented but is feasible to implement, provide the following information.*
    - *Describe your current equipment and/or system as it relates to the measure.*

  See response above. Although technically feasible, the benefits of applying of this technology are limited for the reasons discussed above.

    - *Quantify the estimated heat rate improvement potential from baseline, in percent and Btu/KWh.*
    - *Quantify the expected decrease in on-site power consumption, in MWh per year, if applicable.*
    - *Quantify the cost to implement the measure if it is different than the range provided in Table 2 of the ACE preamble (84 FR 32542). Describe the basis of cost estimates (e.g., vendor estimates, work performed on comparable unit, etc.)*

- *If the measure will require more than two years to implement, provide a schedule with specific dates for increments of progress (40 CFR Part 60, Subpart Ba, §60.24a(d)).*
  - *Awarding contracts of issuing purchase orders*
  - *Start of construction or installation*
  - *Completion of construction or installation*
  - *Final compliance*

Not applicable.

- *If the measure is not already implemented and is not feasible or is limited, provide the following information.*
  - *Describe your current equipment and/or system as it relates to the measure*
  - *Explain why the measure is not feasible or is limited due to the unique characteristics of each unit.*
  - *Specifically address any factors considered in the analysis including remaining useful life of the facility, unreasonable cost of control, physical impossibility of control, or other factors that make application of the measure unreasonable (40 CFR §60.24a(e)).*

Not applicable.

2. Boiler Feed Pump Overhaul or Upgrade

Provide the following for each heat rate improvement measure

- *If the measure is already implemented, provide the following:*
  - *Describe your current equipment and/or system as it relates to the measure including the pump manufacturer's specifications*

Large electric motor powered boiler feed pumps (BFPs) supply feedwater to the steam generator in some units, and are responsible for a large portion of the auxiliary power consumed within a power plant (up to 10 MW from a 500 MW unit). Rigorous maintenance is required to ensure reliability and efficiency are maintained. Wear reduces the efficiency of the pump operations and requires regular rebuilds/upgrades/overhauls. These improvements for electric boiler feedwater pumps reduce auxiliary power demands and improve *net* heat rate, but would not result in measureable improvements in *gross* heat rate.

At Welsh Unit 3, the main boiler feed pump is manufactured by Pacific Pumps/Dresser and driven by a steam turbine and not by an electric motor. As such, for most of the operating range of the Unit (above 24% output), the boiler feed pump is self-regulating and matches the feedwater needed to the load at which the unit is operating. In addition, the boiler feed pump enhances the overall efficiency of the unit because of the reduced auxiliary electric demand (a reduction of as much as 35% of typical auxiliary load). For startup and low load operations, where there is insufficient steam yet available to supply the auxiliary drive steam turbine, a smaller motor-driven feed pump is used to provide the required feedwater. This pump is initially used during unit startup prior to the electric generator producing any output and is removed from service at approximately 24% load. Boiler feed pump turbines can experience degradation and wear over time, and require periodic maintenance to repair turbine blades, exchange rotors, and restore steam seals. The boiler feed pumps at Unit 1 have been regularly maintained in accordance with the manufacturer's specifications and additional overhauls are unnecessary. The Pacific Pumps/Dresser turbine driven boiler feed pump design specifications are: 9132 GPM, 7384 ft head, 88% efficiency, and 5001 RPM. The motor drive feed pump design points are: 2226 GPM 7384 ft head, 81.5% efficiency, and 3490 RPM

At Welsh Unit 3, a regular turbine overhaul is planned approximately every 10 years, or after 80,000 -100,000 hours of service. During the 2019 maintenance outage, the boiler feed pump turbine (BFPT) was replaced with a spare from the retired Welsh Unit 2, due to a previous last stage blade failure on the Unit 3 BFPT. Steam path repairs were completed, and BFPT packing and internal seal replacement was performed to restore clearances. Given that the original design of these units includes a more efficient technology for use above startup flow conditions, and the operator has adopted a regular schedule for overhauls of the pump and turbine, it is reasonable to conclude that no incremental improvement is currently achievable.

- *Provide the date the measure was first installed/operated*

The main turbine-driven boiler feed pump was last overhauled and rebuilt in 2016.

- *If the measure was installed after the baseline period (i.e., years used to determine the baseline rates), quantify the impact on your heat rate, in percent and Btu/KWh.*

Due to the length of time that has passed since this equipment installation, there are no contemporaneous records of unit operating performance maintained by SWEPCO for the requested periods, and heat rate tests were not conducted prior to or after this installation. Given that the original design of these units includes a more efficient technology for use above startup flow conditions, and the operator has adopted a regular schedule for overhauls of the pump and turbine, it is reasonable to conclude that no incremental improvement is currently achievable.

- *If the measure is not already implemented but is feasible to implement, provide the following information.*

- *Describe your current equipment and/or system as it relates to the measure including the pump manufacturer's specifications.*
- *Quantify the estimated heat rate improvement potential from baseline, in percent and Btu/KWh.*
- *Quantify the expected decrease in on-site power consumption, in MWh per year, if applicable.*
- *Quantify the cost to implement the measure if it is different than the range provided in Table 2 of the ACE preamble (84 FR 32542). Describe the basis of cost estimates (e.g., vendor estimates, work performed on comparable unit, etc.)*
- *If the measure will require more than two years to implement, provide a schedule with specific dates for increments of progress (40 CFR Part 60, Subpart Ba, §60.24a(d)).*
    - *Awarding contracts or issuing purchase orders*
    - *Start of construction or installation*
    - *Completion of construction or installation*
    - *Final compliance*

Not applicable.

- *If the measure is not already implemented and is not feasible or is limited, provide the following information.*
    - *Describe your current equipment and/or system as it relates to the measure including the pump manufacturer's specifications.*
    - *Explain why the measure is not feasible or is limited due to the unique characteristics of each unit.*
    - *Specifically address any factors considered in the analysis including remaining useful life of the facility, unreasonable cost of control, physical impossibility of control, or other factors that make application of the measure unreasonable (40 CFR §60.24a(e)).*

Not applicable.

3. Air Pre-Heater and Duct Leakage Control

Provide the following for each heat rate improvement measure

- *If the measure is already implemented, provide the following:*
    - *Describe your current equipment and/or system as it relates to the measure.*
    - *Include the following:*
        - *Description of the type and design, e.g., regenerative vs. recuperative*
        - *Date seals were last replaced, if regenerative*
        - *Current estimated air pre-heater leakage rate and method of determination*
        - *Estimated improved air pre-heater leakage rate, if implemented.*

The two air pre-heaters installed at Welsh Unit 3 are tri-sector regenerative air heaters which rotate. For this unit, air heater seals are typically inspected, repaired or replaced with in-kind seals during equipment outages when the air heater baskets are replaced or when seals are found damaged. Additionally, the air heater internal ducts and sector plates are inspected during maintenance on the air heater, and localized repairs and stationary seal replacements can be made during those inspections if materials are available, or included in future outage plans.

There are products on the market that advertise lowering the amount of leakage experienced within air pre-heater equipment. While it is likely feasible to install such products on Welsh Unit 3, it is currently AEP's opinion that the newer designs for low-leakage seals present risks to unit reliability and air heater functionality that may outweigh any efficiency gains. A thorough technical review is needed to determine applicability and potential benefits for Welsh Unit 3. Plant operators currently use PI system screens for monitoring differential pressure, temperatures and flue gas pressure in the air heater and motor amps for the PA, FD and ID fans in order to assess air heater loading and performance. Application of the low-leakage seal design would require some level of detailed engineering and design by the boiler and/or air heater OEM(s) to determine a suitable method of application and to determine the potential benefits to be gained and reliability risks to consider in each specific case. A feasibility study has not been performed for this unit. Some leakage at this location is necessary to avoid air heater lock-ups due to excessive thermal expansion caused by temperature excursions.

- o *Provide the date the measure was first installed/operated*

The air heater seals were last replaced as a complete set in 2016 during a scheduled outage. Seals are inspected and maintained on an annual basis in accordance with the manufacturer's recommendations during maintenance outages as recommended by the air heater OEM. This maintenance can include repairs to sealing components or replacement of partial sets of seals as necessary, based on damage or wear. The costs for these inspections and repairs have not been separately tracked.

- o *If the measure was installed after the baseline period (i.e., years used to determine the baseline rates), quantify the impact on your heat rate, in percent and Btu/KWh.*

Not applicable.

- *If the measure is not already implemented but is feasible to implement, provide the following information.*

- *Describe your current equipment and/or system as it relates to the measure.*
- *Quantify the estimated heat rate improvement potential from baseline, in percent and Btu/KWh.*
- *Quantify the expected decrease in on-site power consumption, in MWh per year, if applicable.*
- *Quantify the cost to implement the measure if it is different than the range provided in Table 2 of the ACE preamble (84 FR 32542). Describe the basis of cost estimates (e.g., vendor estimates, work performed on comparable unit, etc.)*
- *If the measure will require more than two years to implement, provide a schedule with specific dates for increments of progress (40 CFR Part 60, Subpart Ba, §60.24a(d)).*
    - *Awarding contracts of issuing purchase orders*
    - *Start of construction or installation*
    - *Completion of construction or installation*
    - *Final compliance*

Not Applicable.

- *If the measure is not already implemented and is not feasible or is limited, provide the following information.*
    - *Describe your current equipment and/or system as it relates to the measure*
    - *Explain why the measure is not feasible or is limited due to the unique characteristics of each unit.*
    - *Specifically address any factors considered in the analysis including remaining useful life of the facility, unreasonable cost of control, physical impossibility of control, or other factors that make application of the measure unreasonable (40 CFR §60.24a(e)).*

See previous responses

4. Variable Frequency Drives on Induced Draft Fans and Boiler Feed Pumps

Provide the following for each heat rate improvement measure

- *If the measure is already implemented, provide the following:*
    - *Describe your current equipment and/or system as it relates to the measure.*
    - *Provide the date the measure was first installed/operated*
    - *If the measure was installed after the baseline period (i.e., years used to determine the baseline rates), quantify the impact on your heat rate, in percent and Btu/KWh.*
    - *Provide Fan and pump manufacturer's specifications*

- *If the measure is not already implemented but is feasible to implement, provide the following information*
    - *Describe your current equipment and/or system as it relates to the measure.*

Variable Frequency Drives (VFD) are available that work in concert with traditional electric motors to vary the speed necessary during unit load changes to maximize performance of the driven equipment and reduce losses. This results in a reduction of power consumption as an auxiliary load and helps to maximize the net electrical generation from the unit. The most effective applications are for electric driven boiler feed pumps that control feed water flow and induced draft fans that control air/gas flow through the flue gas path.

At Welsh Unit 3, approximately 50 - 60 percent of the electric demand on a typical unit has already been addressed, including both of the major applications for VFDs identified in the ACE rule. First, the main boiler feed pump is designed by Pacific Pumps/Dresser and is driven by an auxiliary steam turbine that automatically adjusts to the required load and does not consume electricity. As mentioned above in response to Question 2, the Pacific Pumps/Dresser main turbine driven boiler feed pump design specifications are: 9132 GPM, 7384 ft head, 88% efficiency, and 5001 RPM. This pump/turbine combination is placed in service when the unit advances off of the startup system and achieves approximately 24% output and remains in service up through full load.

Second, induced draft (ID) fans were last replaced on the unit in 2016 and are axial flow fans with variable blade vane pitch, which reduce energy losses, enhance operator control, and increase volumetric flow through the unit to increase efficiency. The ID Fan is an axial vane design that operates at 890 RPM. At the boiler maximum continuous rating point, the axial vane ID fan performance is 1155600 CFM inlet, 32.35 in H_2O static pressure rise, 84.2% efficiency.

The axial vane fans deliver substantially similar performance to VFDs. In fact, in its 2009 report on coal-fired power plant heat rate reductions, Sargent & Lundy compared the benefits of centrifugal fans with VFDs to axial vane fans, and determined that the axial vane fans provided slightly superior performance. *Coal-Fired Power Plant Heat Rate Reductions*, Sargent & Lundy, Final Report on Project 12301-001 (Jan. 22, 2009) at p.8-5.

- *Quantify the estimated heat rate improvement potential from baseline, in percent and Btu/KWh.*

Based on the *Sargent & Lundy* Report, SWEPCO anticipates that any difference in the heat rate to install and operate a VFD for the ID fans for both base load and cycling operations would be negligible.

Replacing the main boiler feed pump turbine with an electric motor would impose significant and unnecessary costs and result in a heat rate penalty on the unit. The impact of adopting a VFD for the auxiliary boiler feed pump motor would be extremely low, well below the suggested range offered in the ACE Rule Table 1, as this motor is infrequently used and likely to produce unmeasurable benefits.

- *Quantify the expected decrease in on-site power consumption, in MWh per year, if applicable.*

Similarly, the power differential to operate the axial vane fans versus a conventional centrifugal fan and motor with VFD for both base load and cycling operations is negligible.

- *Quantify the cost to implement the measure if it is different than the range provided in Table 2 of the ACE preamble (84 FR 32542). Describe the basis of cost estimates (e.g., vendor estimates, work performed on comparable unit, etc.)*

As mentioned above, Welsh Unit 3 was able to install axial vane variable flow fans for the induced draft fan applications when the baghouse was installed in 2016. SWEPCO does not have a true cost for adding a VFD onto an existing induced draft centrifugal fan. The axial vane fans were part of the larger baghouse equipment project installed in 2016.

Application of a VFD to the auxiliary boiler feed pump drive motor would likely be cost prohibitive since the motor is approximately 5,000 HP, operates for a limited time only during startup when feed water flow is low and controlled by a regulating valve and the electric generator is not yet connected to the grid (producing 0 MWs). Occasionally the auxiliary feed pump may be brought into service during unit load reduction with the generator producing low MWs for short periods of time (hours) to perform troubleshooting or testing of the main boiler feed pump drive turbine. This period would likely not be part of the emissions performance standard period of testing.

- *If the measure will require more than two years to implement, provide a schedule with specific dates for increments of progress (40 CFR Part 60, Subpart Ba, §60.24a(d)).*
  - *Awarding contracts of issuing purchase orders*
  - *Start of construction or installation*
  - *Completion of construction or installation*
  - *Final compliance*

As discussed above, implementing this measure is likely cost prohibitive and would result in no measureable heat rate improvement over the current equipment.

- *If the measure is not already implemented and is not feasible or is limited, provide the following information.*
  - *Describe your current equipment and/or system as it relates to the measure*
  - *Explain why the measure is not feasible or is limited due to the unique characteristics of each unit.*
  - *Specifically address any factors considered in the analysis including remaining useful life of the facility, unreasonable cost of control, physical impossibility of*

control, or other factors that make application of the measure unreasonable (40 CFR §60.24a(e)).

See previous responses.

5. Blade Path Upgrades for Steam Turbines

Provide the following for each heat rate improvement measure

- *If the measure is already implemented, provide the following:*
  - *Describe your current equipment and/or system as it relates to the measure and include the turbine manufacturer's specifications.*

The best candidates for blade path upgrades are those turbines experiencing steam leaks and blade erosion, where efficiency improvements can be achieved using computerized flow modeling and innovative materials. However, significant variation exists among units. These upgrades are large capital investments and require long lead times.

Welsh Unit 3 is equipped with one combined and opposed-flow high pressure/intermediate pressure (HP/IP) turbine and two low pressure (LP) turbines. This unit has the same turbine design as Welsh Unit 1. A set of rotor spares is available from the retired Welsh Unit 2.

- *Provide the date the measure was first installed/operated*

The steam turbine on Welsh Unit 3 has not been upgraded in the last 10 years. The steam turbine has been overhauled during the last 10 years. Steam turbine sections (HP/IP and LP) were last overhauled in 2017 for the HP/IP turbine and in 2015 for the LP turbines.

During the 2015 and 2017 unit maintenance outages, the turbines were overhauled by opening and assessing condition, cleaning and removal of blade deposits, inspection and non-destructive testing of components, repairing or replacement of worn or damaged blades with like-kind materials and restoration of seals to design clearance values. Closing clearances were recorded and the turbine casings reassembled. Rotor vibration levels are monitored during startup to determine no rubs occur and rotor balance is acceptable. Steam pressures and temperatures are measured to confirm proper steam expansion is taking place.

- *If the measure was installed after the baseline period (i.e., years used to determine the baseline rates), quantify the impact on your heat rate, in percent and Btu/KWh.*

As a result of the turbine overhaul, most of the "recoverable" losses that occur during the normal operating cycle of the steam turbine sections were reduced and overall performance moved closer to design values. A formal heat rate test utilizing highly calibrated test instruments is not typically performed following a turbine overhaul as this is not cost effective. Improvement is typically measured with installed station instrumentation by a reduction in feedwater flow and steam generator heat input for a given MW production as corrected to standard throttle conditions.

- *If the measure is not already implemented but is feasible to implement, provide the following information.*

    - *Describe your current equipment and/or system as it relates to the measure.*

See responses above. In addition, there are steam path upgrades that have been applied to similar units. Typically a steam path upgrade is only cost-justified if other changes to a unit will significantly increase auxiliary loads, and some of those losses can be offset by the turbine upgrade. The baghouse design used at Welsh Unit 3 does not increase auxiliary power demands as much as conventional wet or dry scrubbers, so the investment was not justified when those controls were installed. Currently, demand for electricity is not growing at a rapid pace, and other alternatives for additional generating capacity can be more economically attractive than increasing the output of a coal-fired unit. An economic evaluation for any potential steam path upgrade is recommended. These factors, and the potential to trigger NSR review, would need to be carefully considered in addition to whether a turbine upgrade would fall within the range of the ACE Rule Table 1 estimates as well as the Table 2 range for HR improvement.

    - *Quantify the estimated heat rate improvement potential from baseline, in percent and Btu/KWh.*

Regular overhauls restore and maintain the efficiency of the unit. No specific upgrade designs have been developed for Welsh Unit 3. And therefore the heat rate impact cannot be estimated.

    - *Quantify the expected decrease in on-site power consumption, in MWh per year, if applicable.*

Not applicable.

    - *Quantify the cost to implement the measure if it is different than the range provided in Table 2 of the ACE preamble (84 FR 32542). Describe the basis of cost estimates (e.g., vendor estimates, work performed on comparable unit, etc.)*

The cost of a turbine overhaul or upgrade can vary significantly based on the amount of damage to or degradation of existing components (for an overhaul), or the extent of any design changes associated with an upgrade. Some upgrades may require replacement of turbine rotors, blade carriers and casings in addition to the blades, at a substantially increased cost and scope of work. No specific upgrades have been designed or estimated for the turbines at Welsh Plant.

Steam turbine overhauls and steam path inspections/repairs have been performed at Welsh Unit 3 over the years to return the turbine to near design conditions. These were performed during scheduled outages when turbine inspections have allowed for any liabilities to be addressed and for replacement parts to be procured and made ready for installation. AEP is not aware of any commercial offerings from the turbine OEM for steam path upgrades for Welsh Unit 3. The next regular maintenance opportunity for this turbine is not until 2028 or later. Based on other environmental requirements, Welsh Unit 3 will cease combusting coal by late 2028.

- *If the measure will require more than two years to implement, provide a schedule with specific dates for increments of progress (40 CFR Part 60, Subpart Ba, §60.24a(d)).*
    - *Awarding contracts of issuing purchase orders*
    - *Start of construction or installation*
    - *Completion of construction or installation*
    - *Final compliance*

- *If the measure is not already implemented and is not feasible or is limited, provide the following information.*
    - *Describe your current equipment and/or system as it relates to the measure*
    - *Explain why the measure is not feasible or is limited due to the unique` characteristics of each unit.*
    - *Specifically address any factors considered in the analysis including remaining useful life of the facility, unreasonable cost of control, physical impossibility of control, or other factors that make application of the measure unreasonable (40 CFR §60.24a(e)).*

See above responses.

6. Redesign or Replacement of Economizer

Provide the following for each heat rate improvement measure

- *If the measure is already implemented, provide the following:*
    - *Describe your current equipment and/or system as it relates to the measure.*
    - *Provide the date the measure was first installed/operated*
    - *If the measure was installed after the baseline period (i.e., years used to determine the baseline rates), quantify the impact on your heat rate, in percent and Btu/KWh.*

Not applicable.

- *If the measure is not already implemented but is feasible to implement, provide the following information.*

    - *Describe your current equipment and/or system as it relates to the measure.*

Replacing or redesigning the economizer can optimize temperatures at the exit of the boiler. Boiler layout and construction may limit the applicability of this measure to certain units.

The economizer on Welsh Unit 3 is original and has never been replaced. On occasion, there has been a need to locate and access certain areas of the economizer to address leaking tubes or other physical damage. This repair could result in replacement of a small number of tubes or partial tube sections but no major replacement of tube bundles has been necessary.

During the past year the economizer has performed well, allowing for critical temperatures such as boiler exit gas and air heater gas outlet temperatures to remain within manufacturer specifications throughout the load range.

Because there are currently no issues with the performance of the existing economizer, and no specific design changes have been identified that would allow the unit to increase efficiency without potentially compromising the operations of downstream equipment, there are no known changes to evaluate.

It is technically feasible to replace an economizer either with like-kind design or with some improvements in materials or heat transfer characteristics. Limited like-kind replacements of economizer sections have been made to repair tube damage with no impact to the heat rate of the unit. However, making changes to the economizer design or replacing the economizer in its entirety would have significant impacts on downstream equipment at this unit, including the air heaters, which are sensitive to flue gas temperature changes. The existing economizer is functioning well in its current cycle and condition and does not warrant replacement.

- *Quantify the estimated heat rate improvement potential from baseline, in percent and Btu/KWh.*

For the reasons expressed in the previous answer, there are no heat rate improvements anticipated to be associated with an economizer redesign/replacement project.

- *Quantify the expected decrease in on-site power consumption, in MWh per year, if applicable.*

Not applicable.

Quantify the cost to implement the measure if it is different than the range provided in Table 2 of the ACE preamble (84 FR 32542). Describe the basis of cost estimates (e.g., vendor estimates, work performed on comparable unit, etc.)

No specific designs have been identified that would allow the costs of this measure to be evaluated. Given the commitment to cease combusting coal at this unit is 2028, it is unlikely that a large capital investment like a complete economizer replacement would be recoverable over the unit's remaining useful life.

- *If the measure will require more than two years to implement, provide a schedule with specific dates for increments of progress (40 CFR Part 60, Subpart Ba, §60.24a(d)).*
  - *Awarding contracts of issuing purchase orders*
  - *Start of construction or installation*
  - *Completion of construction or installation*
  - *Final compliance*

- *If the measure is not already implemented and is not feasible or is limited, provide the following information.*
  - *Describe your current equipment and/or system as it relates to the measure*
  - *Explain why the measure is not feasible or is limited due to the unique characteristics of each unit.*
  - *Specifically address any factors considered in the analysis including remaining useful life of the facility, unreasonable cost of control, physical impossibility of control, or other factors that make application of the measure unreasonable (40 CFR §60.24a(e)).*

See previous responses.

7. Heat Rate Improvement Best Management O& M Practices

Provide the following for each heat rate improvement measure

- *If the measure is already implemented, provide the following:*
  - *Describe your current equipment and/or system as it relates to the measure and include a description of the current O&M practices for the following, if performed, including frequency: staff training in heat rate improvement practices; On-site heat rate performance appraisals; steam surface condenser cleaning.*

Heat rate improvement "awareness training" is suggested as a means of elevating awareness of specific heat rate improvement efficiency measures among the operations and maintenance staff at units including the Welsh Plant affected by the rule. In the response to ACE Rule comments, EPA recognized that the level of awareness at individual units could vary dramatically, and that states might simply take into consideration whether there are existing programs at specific units as part of the overall evaluation of the candidate technologies. Capital costs are anticipated to be minimal and the impact of implementing new or existing programs is difficult to estimate and expected to be widely variable.

As generating units across the country have joined regional transmission organizations and begun offering the output of their units into competitive generation markets, cost-effective operation of individual units has become increasingly important. AEP units in the west are dispatched as part of SPP, which has a robust day-ahead energy market. As a result, increasing attention has been focused on ways to improve efficiency and lower operating costs.

AEP provides training, monitoring tools, and "best practice" sharing forums for its employees as a way to help plant operators and staff to improve their awareness and equip them with means to maintain efficient operations and identify further efficiency improvements. Some of these tools and practices include:

- Operator training
- HRI classes, focusing on plant system optimization, are held at the Generation unit simulator center in St. Albans, WV and available to SWEPCO / Welsh Unit 3 personnel
- An automated Monitoring & Diagnostics Center (MDC)
- Equipment control systems capable of automatically responding to changing conditions
- Regular technology updates and reviews
- Participating in and contributing to AEP Operational Excellence Program for best practices, including maximizing performance and reducing heat rate
- Maintaining thermal performance models of the unit design cycle with equipment references
- MDC performs start-up and shutdown analyses related to thermal ramp rates for Welsh Unit 3 boiler tubes/headers, heaters and turbine components with the goal of reducing equipment degradation, improved long-term performance, and reliability.

The degree to which individual unit operators, supervisors and engineers undergo various parts of this training depends upon their position and desire to further develop and take on additional responsibilities. Some positions such as a Control Center Operator (CCO) require prior successful completion of the NUS Heat Rate course. The CCO is also responsible to monitor "controllable" heat rate monitor screens in the unit control room to aid in determining the most efficient unit operation conditions for Welsh Plant.

The Welsh Plant performs heat rate performance appraisals on an ongoing basis. The plant monitors heat rate deviations on an ongoing basis through their PI systems (as described in response to questions 1 above), and initiates corrective action when warranted.

The Welsh Plant performs condenser tube leak checks during every maintenance outage to address any leaking tubes in order to maintain optimum performance and reduce the effects of contamination. Condenser tube cleanings are performed when performance monitoring indicates the need. Condenser tube fouling has not typically been a problem on Welsh Unit 3, but when it occurs it has typically been caused by clam shells blocking the flow of cooling water in the tubes. This condition is effectively resolved by back washing during outages. We monitor performance by examining the relationship between cooling water temperature and condenser pressure during different seasonal periods. This relationship has tracked closely with the design parameters. The MDC has several models built around condenser performance which are closely monitored. The current cleaning methods are working well, and the quality of the cooling water and steam purity in the condensate cycle are being held close to optimum values. The last time the main and auxiliary condensers required cleaning to remove scale buildup was in 2008.

- *Provide the date the measure was first installed/operated*

Not applicable.

- *If the measure was installed after the baseline period (i.e., years used to determine the baseline rates), quantify the impact on your heat rate, in percent and Btu/KWh.*

Existing programs and measures are currently being employed and improvements are reflected in the historic emissions data for this unit. The precise percentage in unknown. No quantifiable incremental increase in heat rate improvement is anticipated as a result of continuing the existing practices, which include regular technology reviews and updates

- *If the measure is not already implemented but is feasible to implement, provide the following information.*
  - *Describe your current equipment and/or system as it relates to the measure.*
  - *Quantify the estimated heat rate improvement potential from baseline, in percent and Btu/KWh.*

- *Quantify the expected decrease in on-site power consumption, in MWh per year, if applicable.*
- *Quantify the cost to implement the measure if it is different than the range provided in Table 2 of the ACE preamble (84 FR 32542). Describe the basis of cost estimates (e.g., vendor estimates, work performed on comparable unit, etc.)*
- *If the measure will require more than two years to implement, provide a schedule with specific dates for increments of progress (40 CFR Part 60, Subpart Ba, §60.24a(d)).*
  - *Awarding contracts of issuing purchase orders*
  - *Start of construction or installation*
  - *Completion of construction or installation*
  - *Final compliance*

Not applicable.

- *If the measure is not already implemented and is not feasible or is limited, provide the following information.*
  - *Describe your current equipment and/or system as it relates to the measure*
  - *Explain why the measure is not feasible or is limited due to the unique characteristics of each unit.*
  - *Specifically address any factors considered in the analysis including remaining useful life of the facility, unreasonable cost of control, physical impossibility of control, or other factors that make application of the measure unreasonable (40 CFR §60.24a(e)).*

Not applicable.

Recommended Final Standards for State Plan – 40 CFR 60.5755a

Provide the expected heat rate and recommended CO_2 emission standard(s) for each designated facility after implementation of all HRI measures determined to be feasible. Section 60.5755a(a)(1) of the ACE rule requires the standard of performance for each designated facility be an emission performance rate relating mass of CO_2 emitted per unit of energy (e.g., lb CO_2/MWh). The EPA has indicated that work practice standards cannot be used in lieu of establishing a numerical limit for any of the measures, including those measures that only impact net generation. The ACE rule does not allow for parametric monitoring, mass-based limits, concentration-based limits, or a trading program.

Most of the candidate HRI technologies identified by EPA have already been applied at Welsh Unit 3, or further potential reductions in heat rate have not been identified for the specified technology. Figure 4 below contains a summary of the applicability of the various measures.

Figure 4: Summary of HRI Measures and Applicability

HRI Measure	The Same or Equivalent Measure Currently Installed or Conducted?	Further Improvements Available and Technically Feasible?	Are the Technologies or Further Improvements Economically Justified?
Neural Network/ Intelligent Sootblowers	Yes	No	N/A
Boiler Feed Pumps	Yes	No	N/A
Air Heater Seals/Duct Leakage Control	Yes	No	N/A
VFDs	Yes	No	N/A
Steam Turbine Upgrades	Yes	No	N/A
Replace/Redesign Economizer	Yes	No	N/A
Heat Rate Awareness Training, Evaluation, and O&M Practices	Yes	Evaluated as part of ongoing performance monitoring	Determined as part of budgeting process

As outlined above, measures equivalent to the neural network/intelligent sootblowing systems, boiler feed pump technology, air heater seals and duct leakage control, and variable frequency drives are already currently employed and maintained through regular inspections and maintenance. No specific upgrades for the unit's economizer or steam turbines have been made available through the original equipment manufacturers. Regular heat rate improvement evaluation and training is conducted for facility personnel, and through the centralized MDC and simulator training facility; on-site opportunities for further heat rate improvements are evaluated and incorporated into capital improvement plans and outage schedules. Condenser cleaning and monitoring is conducted on a regular basis.

Step 1

• *Expected heat rate in Btu/KWh after implementation of all measures recommended as feasible, gross and/or net basis*

• *Recommended CO_2 lb/MWh emission standards, gross and/or net basis*

o *Recommended emission limits based on percent reduction in CO_2 baseline rate, as determined above, by applying percent improvement from BSER measures determined to be feasible*

o *Rolling 12-boiler operating month compliance basis, or alternative basis, calculated similar to baseline rate*

o *If separate standards are recommended based on different operating loads, clearly identify the operating load criteria associated with each segment (e.g., firing rate capacity associated with each segment) Affordable Clean Energy Rule State Plan Company Information Collection Request February 24, 2020 Page 5 of 5*

o *Provide any suggestions on how to address measures that only affect net generation*

An achievable performance standard must accommodate not only heat rate degradation, but the inherent variability associated with both controllable and uncontrollable factors that affect heat rate, the uncertainty associated with the measurement technologies, and the full range of operating conditions the facility is expected to encounter throughout the compliance period. As part of the bulk electric system, Welsh Unit 3 and other electric generating units have public service obligations to the ultimate consumers of electricity, obligations to the regional transmission operators and reliability authorities to be available to provide service during all periods, and obligations to respond to the dispatch instructions received from those operators. These obligations are legally enforceable and could subject SWEPCO to significant fines and penalties if the operation of Welsh Unit 3 is compromised.

EPA recognizes that the standards of performance developed by the states must account for the variability in performance at individual units, and has suggested that either multiple emissions standards be developed, or that states select a single standard of performance based on a standard set of operating conditions. *See* 84 Fed. Reg. 32552 (July 18, 2019). Based on the ease of implementation and ability to use regularly scheduled emissions testing under standard conditions to demonstrate compliance, a single performance standard could be developed using the baseline data that would be supported by stack testing at representative conditions. There are a number of different standard statistical evaluations that can be performed using this data to attempt to identify a performance standard that could be measured under full load operating conditions using a reference test method. A performance standard based on the upper predictive limit (UPL) at full load is one option. UPLs have been used by EPA in establishing standards under 40 CFR Part 63 for boilers and industrial furnaces, as well as other standards under the Clean Air Act. *See, CO CEMS MACT Floor Analysis August 2012 for the Industrial, Commercial, and Institutional Boilers and Process Heaters National Emission Standards for Hazardous Air Pollutants Major Source*, Docket ID Item No. EPA-HQ-OAR-2002-0058-3877.

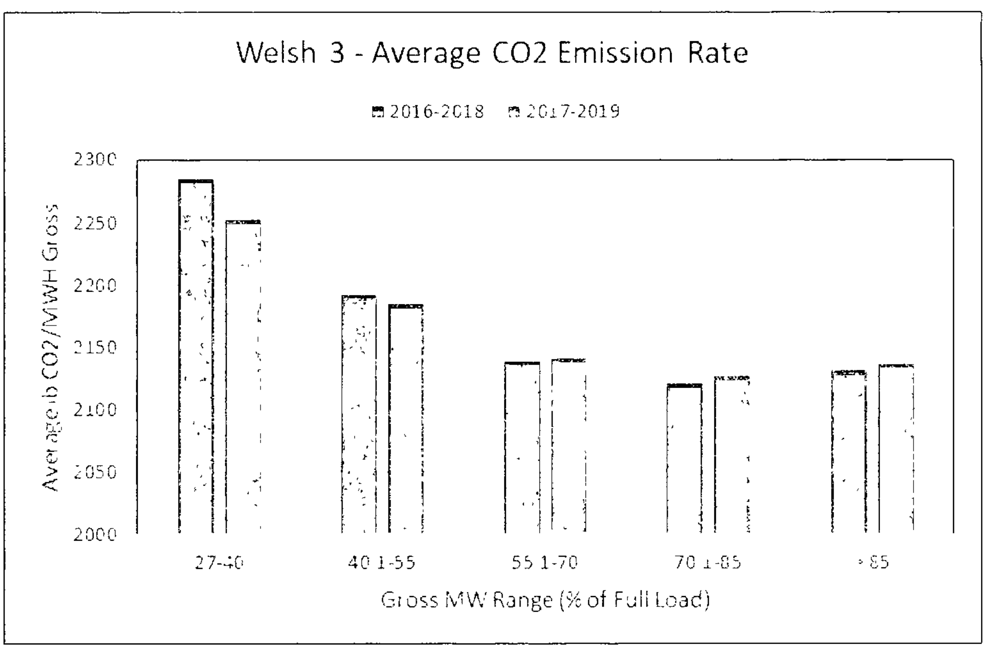
However, there is a wide range of variability in measured values across load ranges, and continuous data can be developed from the certified monitors and other information under Part 60, which is typically used for performance standards developed under Section 111 of the Clean Air Act. Variability from all sources must be accounted for in order to make the performance standard achievable. As shown in Figure 1, the "baseline" rate calculated as prescribed for TCEQ's default standard varies slightly over two overlapping recent periods at this unit, which suggests that the standard is not robust enough to accommodate even moderate shifts in load. The baseline CO_2 emission rate calculated for Welsh Unit 3 based on the 12-month rolling averages from 2017-2018 shown in Figure 1, above is 2,197 pounds per MWh gross, but a similar calculation for the period from 2018-2019 yields a baseline rate of 2,207 pounds per MWh gross. With greater changes in the unit's load profile, these differences would be much more significant. A simple average or mean of the historic data even with multiple standard deviations therefore would be unreasonable, given the uncontrollable factors that have significant impacts on heat rate and CO_2 emissions.

TCEQ has recommended the use of unbiased CEMS data as the compliance determination method for a performance standard, but the wide range of values across the normal operating range of electric generating units, the lack of information during start-up to calculate an accurate value in the form of the proposed standard, the uncontrollable factors affecting emissions performance, and the complexity of attempting to create and track a standard make this approach inherently less reliable than a reference method test performed under a standard set of conditions. These uncertainties create an attendant risk of non-compliance unless all of these factors can be accounted for when the performance standard is established.

The proposed "default method" suggested by TCEQ addresses some, but not all of these factors. The addition of a value that is three times the standard deviation among the measured values over a 24-month operating period may provide sufficient margin that compliance could be maintained if other unit operating conditions remained the same. Similar standards have been proposed in other states, and many states are considering whether it would be necessary to exclude certain values (i.e., CO_2 emission rates above 3,000 lb/MWh, values below 1,000 lb/MWh, values for loads below the minimum stable operating range, or other defined outliers) from the baseline calculation and compliance determination methods in order to adequately deal with sources of variability and uncertainty.

However, the electricity markets are undergoing an unprecedented change, and the introduction of increasing amounts of renewable resources continues to pressure coal-fired generators to play a load following role, and spend substantially more time operating at low or minimum loads in order to be able to ramp up when renewable resources are unable to provide sustained generation. Because of the substantial variation in CO_2 emission rates at low loads versus full load, *see* Figure 2, a set of "binned" standards based on unit operating load may provide a more reasonable assurance of continued compliance if a unit is required to greatly increase the time spent at low loads in future years. An example of the load bins that could be used to establish average CO_2 emission rates and determine compliance with the final standards is presented below in Figure 5.

Figure 5: CO_2 Emission Rates at Various Load Bins for Welsh Unit 3



SWEPCO recommends that if CEMS data is used to determine compliance and all operating periods are included, multiple load bins should be established for each unit, and a margin of three times the standard deviation should be added to develop a separate standard for each load bin. Using the data provided for the baseline period, the 24-month baseline average plus three standard deviations developed for the period from 2017-2018 should be used. This period is more representative of higher CO_2 emission rates associated with lower load operations. Additional adjustments (such as the elimination of outliers or other means of eliminating the impacts of multiple unit start-ups) may also be required. Figure 6 below contains a table of the separate load ranges and their baseline CO_2 emission rates that would be used to demonstrate compliance using the binned load range methodology.

Figure 6: Welsh Unit 3 Binned Compliance Standards

Welsh Unit 3			2016 - 2018					2017 - 2019				
					CO2 Emission Rate lb/MWH Gross)					CO2 Emission Rate lb/MWH Gross)		
Bin	% Gross MW	Gross MW	# Hours	% Hours	Average	3 Std Dev	Average + 3 Std Dev	# Hours	% Hours	Average	3 Std Dev	Average + 3 Std Dev
1	27-40	150-224	3216	17%	2286	234	2520	4594	22%	2253	177	2430
2	40 1-55	225-309	2756	14%	2193	183	2376	3342	16%	2185	172	2357
3	55.1-70	310-393	2745	14%	2139	134	2273	2966	14%	2141	141	2282
4	70.1-85	394-477	3161	17%	2121	102	2223	3300	16%	2127	113	2240
5	> 85	478-561	7175	38%	2132	77	2209	6727	32%	2136	89	2225
All	≥ 27	150-561	19053		2150	231	2381	20929		2155	201	2356

For each future compliance period, MWh weighted average values should be calculated for each bin and averaged together. The formula used to calculate the 24-month average compliance limit is set forth below:

$$\textit{Compliance limit (lbs-CO2/MWh}_g\textit{)} = \frac{[(h_1*r_1)+(h_2*r_2)+(h_3*r_3)+(h_4*r_4)+(h_5*r_5)]}{\textit{total MWh in all load bins}}$$

Where h_n = equals total MWh in load bin_n during the compliance period

And r_n = equals the historic average rate for bin_n + 3 standard deviations

The averaging period for the recommended standard should consist of at least 24 consecutive operating months. If the CO_2 emission rate for the compliance period (calculated by dividing the total pounds of CO_2 emitted as measured at all loads above the minimum stable operating load by the total megawatt hours of generation in all load bins above the minimum stable operating load) is less than the compliance limit, the unit would be in compliance with the standard.

There are a number of other sources of uncertainty and variability that may affect future compliance with a CO_2 emission standard, both known and unknown. A detailed discussion of such factors, and a much more complicated proposed standard was recently included in a partial state plan developed by the West Virginia Department of Environmental Protection (WVDEP) for the Longview Power Plant available at https://dep.wv.gov/daq/publicnoticeandcomment/Documents/Proposed%20WV%20ACL%20State%20Partial%20Plan.pdf. Although WVDEP rejected an adjustment based on three times the standard deviation in its plan, its ultimate standard used two times the standard deviation plus additional adjustments based on fuel quality and uncontrollable operational and mechanical issues at the unit. SWEPCO considered these sources of additional variability, but chose to include TCEQ's default adjustment in its recommended standard due to its ease of implementation.

Step 2

• *Detailed justification for recommended final standards, which may consider remaining useful life of the facility and other factors such as unreasonable cost of control, physical impossibility of control, or other factors that make application of the measure unreasonable (40 CFR §60.24a(e)).*

• *If you are relying on remaining useful life as part of the justification for the final recommended standard, provide the following information.*

o *Number of years the unit is expected to continue operating beyond 2019 given current economic conditions*

o *Basis of estimated remaining useful life*

o *Feasibility of making a federally enforceable commitment to a future retirement date*

SWEPCO has used the most recent operating data for Welsh Unit 3 to provide emission data and heat rates that reflect the degree of emission limitation achievable using current equipment and operating and maintenance practices. This unit will be retired no later than October 17, 2028, less than four and a half years after the commencement of the first ACE compliance period. It would be unreasonable to require this unit to make capital investments or spend significant additional resources for operating and maintenance expenses beyond those required to maintain efficient operation of the unit. The recommended standard must be flexible enough to accommodate end of life operations for this unit, and therefore setting the standard based on historic averages within each of the load bins described above plus three standard deviations is appropriate.

Additional Information

• *Description of any future expected overhauls or equipment replacements not already accounted for in measures listed above that would be needed to maintain unit heat rate and CO2 emission rate beyond initial compliance, e.g., shortened equipment life resulting in more frequent replacement and additional costs*

• *Description of any future potential installations of environmental control equipment that would increase the on-site parasitic load, including resulting estimated potential increase in on-site electricity use in MWh per year Facility*

Not applicable.

Future Operational Information—40 CFR §60.5740a(4)(i)(A)–(F)

Responses regarding future operational characteristics can be based on publicly available information rather than potentially confidential company-specific information, if you provide the source of the publicly available information (e.g., DOE data, information provided by utilities to the applicable regional transmission organization and/or independent system operator).

- *Summary of each designated facility's anticipated future operational characteristics and basis of estimation*
    - *Annual gross and net generation, MWh*
    - *Annual CO2 emissions, in tons*
    - *Fuel use, prices, and carbon content*
    - *Fixed and variable O & M costs*
    - *Heat rates*
    - *Electric generating capacity and capacity factors*
- *Future operational characteristics should be provided for 2025, 2030, and 2035. For units with an expected retirement date earlier than 2035, data only needs to be provided for those five-year intervals prior to the expected retirement date.*

SWEPCO has provided the requested projected information as confidential business information in a separately attached Exhibit A for calendar year 2025 only, since Welsh Unit 3 will cease combusting coal in 2028.

SOAH DOCKET NO. 473-21-0538
PUC DOCKET NO. 51415

SOUTHWESTERN ELECTRIC POWER COMPANY'S RESPONSE TO SIERRA CLUB'S SECOND SET OF REQUESTS FOR INFORMATION

Question No. SC 2-17:

Refer to Schedule H-5.3b at pages 4-7.

a. Please explain whether (and what portion of) the identified ELG or CCR costs at Flint Creek could be avoided by a commitment to cease burning coal under the CCR Rule's alternative closure provisions, 40 C.F.R. § 257.103, or the ELG Rule, 40 C.F.R. § 423.19(f).
b. Has SWEPCO conducted any economic or technical alternatives analysis (including any retirement versus retrofit analysis) for the Company's CCR or ELG compliance costs at its coal-burning units? If yes, please provide all such analyses, including all supporting calculations, data, documents, technical or economic reports or presentations, modeling input and output files, and workpapers associated with each such analysis. If the Company did not conduct any such analyses, explain why.
c. Please provide the CCR and ELG project cost and schedule for each of SWEPCO's coal plants, including a detailed summary of the actual cost for completed phases of the projects, the date of completion, and all anticipated remaining costs and spend dates.
d. At any time after EPA issued its proposed revised ELG Rule in November 2019, 84 Fed. Reg. 64,620, or after its final rule, 85 Fed. Reg. 64,650, did SWEPCO conduct any further economic, technical, or alternatives analysis (including any retirement analysis) for the Company's ELG costs referenced in Schedule H-5.3b at pages 4-7. If yes, please provide all such analyses, including all supporting calculations, data, documents, technical or economic reports or presentations. If not, please explain why.
e. At any time after EPA issued its proposed revised CCR Rule in December 2019, 84 Fed. Reg. 65,941, or after its final rule, 85 Fed. Reg. 53,516, did SWEPCO conduct any further economic, technical, or alternatives analysis (including any retirement analysis) for the Company's CCR costs referenced in Schedule H-5.3b at pages 4-7. If yes, please provide all such analyses, including all supporting calculations, data, documents, technical or economic reports or presentations. If not, please explain why.

Response No. SC 2-17:

a. See Attachments 1 and 2 provided in the Company's response to part c of this question, for costs labeled "CCR/ELG". It is that portion of future costs that would not be required, if before October 2021, the Company declared its intention to retire Flint Creek by the end of 2028.

b. Please see the supplemental response to CARD 2-10 for the Company's CCR/ELG analysis of Welsh 1&3, Pirkey and Flint Creek.
c. See Sierra Club 2-17 Attachments 1, 2, and 3, for a detailed summary of the historical and forecasted SWEPCO share of the cost for each phase of the CCR and ELG projects, which include direct and indirect capital install costs, capital removal, and AFUDC. Also included are the CCR/ELG project estimated completion dates by phase.
d. Please see the response to SC 2-17 b.
e. Please see the response to SC 2-17 b.

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SWEPCO CCR/ELG Project Annual Costs[1,2,3]						
	< 2020	2021	2022	2023	2024 >	Total
Flint Creek - 50%	$ 1,986,963	$ 7,883,347	$ 13,000,145	$ 3,210,858		**$ 26,081,313**
Direct Cost						$ 20,228,821
CCR/ELG	$ 1,258,823	$ 2,814,563	$ 7,629,123	$ 1,373,896		$ 13,076,404
Pond Closure-Primary Bottom Ash Pond	$ 149,091	$ 3,442,701	$ 2,504,912	$ 1,055,712		$ 7,152,416
Indirect Cost						$ 5,852,493
CCR/ELG	$ 558,295	$ 832,807	$ 2,293,578	$ 537,697		$ 4,222,376
Pond Closure-Primary Bottom Ash Pond	$ 20,755	$ 793,276	$ 572,534	$ 243,553		$ 1,630,117
Welsh - 100%	$ 3,662,482	$ 3,424,341	$ 3,120,146	$ -	$ 11,082,181	**$ 21,289,149**
Direct Cost						$ 16,917,015
CCR/ELG	$ 2,128,015	**Project Cancelled**				$ 2,128,015
Pond Closure-Primary Bottom Ash Pond	$ 471,000	$ 253,000	$ -	$ -	$ 8,940,000	$ 9,664,000
Pond Closure-Bottom Ash Storage Pond	$ -	$ 2,562,500	$ 2,562,500	$ -	$ -	$ 5,125,000
Indirect Cost						$ 4,372,134
CCR/ELG	$ 992,817	**Project Cancelled**				$ 992,817
Pond Closure-Primary Bottom Ash Pond	$ 70,650	$ 51,195	$ -	$ -	$ 2,142,181	$ 2,264,026
Pond Closure-Bottom Ash Storage Pond	$ -	$ 557,646	$ 557,646	$ -	$ -	$ 1,115,291
Pirkey - 85.96%	$ 2,155,441	$ 308,499	$ 514,926	$ 1,730,452		**$ 4,709,319**
Direct Cost						$ 4,140,343
CCR/ELG	$ 1,994,610	**Project Cancelled**				$ 1,994,610
Pond Closure-Bottom Ash Ponds	$ 71,519	$ 227,794	$ 415,187	$ 1,431,234		$ 2,145,734
Indirect Cost						$ 568,975
CCR/ELG	$ 73,846	**Project Cancelled**				$ 73,846
Pond Closure-Bottom Ash Ponds	$ 15,467	$ 80,705	$ 99,739	$ 299,218		$ 495,130

[1]Includes SWEPCO share of direct and indirect capital install costs, capital removal, and AFUDC

[2]Welsh and Pirkey CCR/ELG cost transferred to O&M expense.

[3]As of January 31, 2021.

SWEPCO CCR/ELG Project Stage Costs[1,2,3]

	Stage 0-2		Stage 3-4		Stage 5-7		
	Actual	Estimate To Complete	Actual	Estimate To Complete	Actual	Estimate To Complete	Total
Flint Creek - 50%							**$ 26,081,313**
Direct Cost							$ 20,228,821
CCR/ELG	$1,242,707		$145,369	$2,941,440		$8,746,888	$ 13,076,404
Pond Closure-Primary Bottom Ash Pond	$ 73,260		$100,123	$ 143,747		$6,835,287	$ 7,152,416
Indirect Cost							$ 5,852,493
CCR/ELG	$ 473,076		$ 85,219	$ 832,807		$2,831,275	$ 4,222,376
Pond Closure-Primary Bottom Ash Pond	$ 10,377		$ 15,566	$ 788,087		$ 816,086	$ 1,630,117
Welsh - 100%							**$ 21,289,149**
Direct Cost							$ 16,917,015
CCR/ELG	$2,128,015			**Project Cancelled**			$ 2,128,015
Pond Closure-Primary Bottom Ash Pond	$ 471,000		$129,463	$ 123,537		$8,940,000	$ 9,664,000
Pond Closure-Bottom Ash Storage Pond	$ -			$ 750,000		$4,375,000	$ 5,125,000
Indirect Cost							$ 4,372,134
CCR/ELG	$ 992,817			**Project Cancelled**			$ 992,817
Pond Closure-Primary Bottom Ash Pond	$ 70,650		$ 21,917	$ 29,278		$2,142,181	$ 2,264,026
Pond Closure-Bottom Ash Storage Pond	$ -			$ 177,750		$ 937,541	$ 1,115,291
Pirkey - 85.96%							**$ 4,709,319**
Direct Cost							$ 4,140,343
CCR/ELG	$1,994,610			**Project Cancelled**			$ 1,994,610
Pond Closure-Bottom Ash Ponds	$ 71,519			$ 361,032		$1,713,183	$ 2,145,734
Indirect Cost							$ 568,975
CCR/ELG	$ 73,846			**Project Cancelled**			$ 73,846
Pond Closure-Bottom Ash Ponds	$ 15,467			$ 80,705		$ 398,958	$ 495,130

[1]Includes SWEPCO share of direct and indirect capital install costs, capital removal, and AFUDC

[2]Welsh and Pirkey CCR/ELG cost transferred to O&M expense.

[3]As of January 31, 2021.

SWEPCO CCR/ELG Project Stage[1,2,3] Completion Dates

	Stage 0-2		Stage 3-4		Stage 5-7	
	Actual	Schedule	Actual	Schedule	Actual	Schedule
Flint Creek						
CCR/ELG	12/1/2020			1/1/2022		2/28/2023
Pond Closure-Primary Bottom Ash Pond	8/1/2020			4/1/2021		2/28/2023
Welsh						
CCR/ELG	12/1/2020	**Project Cancelled**				
Pond Closure-Primary Bottom Ash Pond		3/1/2021		2/1/2027		10/17/2028
Pond Closure-Bottom Ash Storage Pond				6/1/2021		10/1/2022
Pirkey						
CCR/ELG	12/1/2020	**Project Cancelled**				
Pond Closure-Bottom Ash Ponds	8/1/2020			4/1/2021		10/17/2023

[1]Stage 0-2: Study to Conceptual Design

[2]Stage 3-4: Preliminary & Detail Engineering and Design

[3]Stage 5-7: Construction, Commissioning, Start Up, and Close Out